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Sharpening High-Speed Steel and Carbide-Tipped Hobs

By CHARLES H. WICK

TO obtain the high standards of precision required in modern gear drives, considerable care must be exercised in the operation and maintenance of hobs. The close tolerances to which these relatively expensive cutting tools are made and the precision hobbing machines available for use will not produce high quality, accurate gears if the hob is improperly operated or sharpened. Consistently accurate work, fine finish, fast production, and long tool life can be obtained only when hobs are resharpened to their original accuracy.

Recent widespread acceptance of carbide-tipped hobs for producing non-metallic gears has introduced additional hob-sharpening problems. Recommendations covering grinding wheels, coolants, feeds, speeds, and methods of grinding and inspecting for both high-speed steel

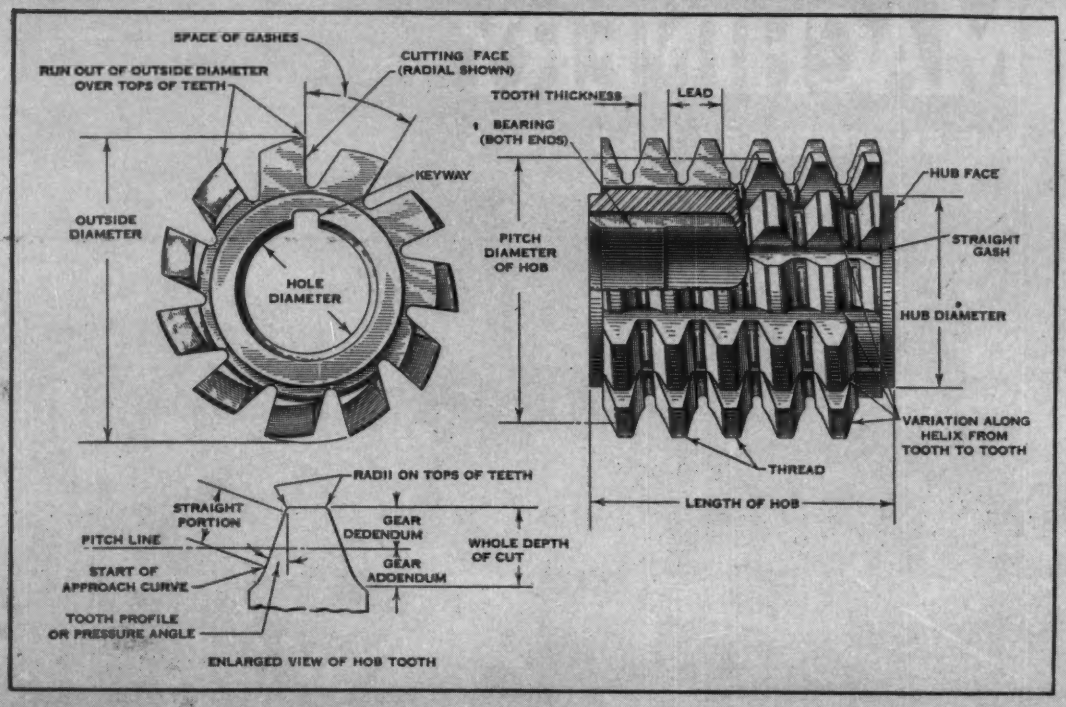


Fig. 1. Nomenclature of Various Parts of a Hob. A Single-thread, Right-hand Ground Hob is Shown in the Sketch

and carbide-tipped hobs will be given in the following.

A hob can be defined as a worm-shaped cutter that is gashed axially, or in a helical path, to produce a series of rack-shaped cutting edges. Hobs are extensively used in the production of spur gears, helical gears, worm-wheels, and splined shafts. They should not be confused with multiple-thread milling cutters, which have annular rows of teeth lying in planes perpendicular to the axis.

To avoid confusion in this discussion of hob sharpening, the nomenclature for various parts of a typical hob is indicated in Fig. 1. Standard hobs for both spur and helical gears generally have straight gashes, parallel to the axis of the hob, when the thread angle is less than 4 degrees. When the thread angle is 4 degrees or more, helical gashes are provided.

In manufacturing hobs, the teeth are formed with a uniform relief on special lathes equipped with a reciprocating tool action. This insures that the tooth profiles will remain the same, regardless of how much the faces of the teeth are ground back. Repeated sharpenings, however, do increase the thread angle of the hobs.

How Often Do Hobs Require Sharpening?

It is false economy to continue using a hob until it becomes so dull that an excessive amount of stock has to be removed in resharpening it. If the hob becomes too dull, it will produce inaccurate work with a poor surface finish, the time required for sharpening will be greater, and the hob will become worn-out sooner. The total number of work-pieces that can be cut per hob is substantially increased if the hob is resharpened frequently.

It has been found from experience that hobs should be sharpened at regular intervals after cutting a certain number of parts or after a definite period of operation. Production or operation time between sharpenings can only be ascertained from experience, since this will vary with the feed and speed used, the material being cut, the pitch of the hob, etc. Certain carbide-tipped hobs have been in operation for more than two years without resharpening.

In no case should a hob be allowed to operate beyond the point where more than 0.015 inch of material will have to be removed from the cutting face of any tooth. In fact, with carbide-tipped hobs, not over 0.010 inch of stock should have to be removed from any cutting face.

Shifting Position of Hob Lengthens its Life

The position of the hob should be shifted frequently to obtain the best cutting conditions and the longest hob life. Many shops establish a rule that after a given amount of wear, the hob must be shifted to another position. From the amount of wear on the hob teeth, the operator can calculate the distance the hob should be shifted. Since all the teeth will not wear

equally, the tooth showing maximum wear should clear the cut after shifting the hob. It is not necessary to shift the hob far enough to clear all the teeth previously used, since those showing minimum wear can be re-used in the new location.

Hobs should be shifted or resharpened when about 0.006 inch (and not more than 0.015 inch) of stock has to be removed in order to restore any tooth to a keen cutting edge. An automatic hob-shifting attachment developed by the Barber-Colman Co. shifts the hob a preset amount to a new cutting position after each cycle. Hob life has been increased as much as 50 per cent in some cases by means of this attachment.

Machines Employed for Hob Sharpening

Grinding machines specifically designed for sharpening hobs are available with automatic controls for accurate indexing and for regulating the amount of metal to be removed at each pass of the grinding wheel and the total amount of material to be removed during the sharpening process. A machine of this type, manufactured by the Barber-Colman Co., is shown in Fig. 2.

On all such machines, a table carrying the tool to be sharpened between centers reciprocates past the grinding wheel. After each cycle, consisting of a forward and return stroke of the tool, the tool is automatically indexed to sharpen the next row of teeth. Following a complete revolution of the tool, it is automatically advanced a pre-selected amount for an additional cut on each tooth. For helical-gashed hobs, rotation of the work-spindle is positively controlled by an adjustable sine bar, which actuates a rack and pinion below the indexing head of the table. As the table moves, the tool is rotated to produce the required lead.

When the number of hobs to be sharpened does not warrant the cost of a machine especially designed for this purpose, the tools can be sharpened on conventional grinding machines. The backs of the teeth on straight-gashed hobs can be accurately ground by the tool manufacturer to provide correct indexing surfaces for sharpening on other than automatic hob-sharpening machines. Then the tooth-rest of the cutter grinder can be placed on back of the hob teeth when no other method of indexing is available.

Helical-fluted hobs cannot be indexed from the back of the teeth, but must be sharpened by adjusting the set-up for individual flutes unless automatic means are available. Guide cylinders or formers with accurately milled or ground gashes having the proper angle and index to match the hob are sometimes employed for sharpening helical-gashed hobs when automatic indexing means are not available. The guide is mounted on the same arbor with the hob being sharpened, so that the guide finger on the grinding machine will be piloted by the gashes in the guide cylinder and will permit the arbor to be revolved correctly as it is traversed. Such guide cylinders are not required on automatic hob-sharpening machines.

Selecting the Proper Grinding Wheel

For rough-sharpening high-speed steel hobs, a vitrified-bonded aluminum-oxide grinding wheel of 60 grain size, G hardness, and 6 struc-

Fig. 2. Hob-sharpening Machine Provided with Automatic Controls for Indexing and Stock Removal

ture is recommended. As the gashes between the rows of teeth on the hob widen, due to resharpening, coarser grained wheels, such as 54 or 46, can be employed to obtain faster stock removal rates. For finish-sharpening, a finer grit, harder wheel, of approximately 80 grain size and I hardness, should be used. Flat grinding wheels formed on one face, as shown at *A* in Fig. 3, are most desirable.

When used dry, aluminum-oxide grinding wheels should be dressed at regular intervals during the sharpening operation. Frequent dressing is required to avoid loading and keep the wheel free-cutting, as well as to prevent the corners of the wheel from breaking down. If the corners break down, rounded corners on the wheel may be of large enough radii to interfere with the root of the hob tooth form. A final dressing is recommended immediately before "sparking out."

Resinoid-bonded diamond wheels of 100 concentration and J hardness are recommended for machine sharpening of carbide-tipped hobs. Metal-bonded diamond wheels can be used for off-hand grinding. A diamond grain size of 120 to 220 is generally used for both rough- and finish-grinding. For extra fine finishes, a grain size of 400 or 500 is sometimes employed. A formed flat shape is also preferred for diamonds wheels, as shown at *B* in Fig. 3. Glaze can be removed from diamond wheels by scrubbing the face lightly with lump pumice.

To true or straighten the grinding face of a diamond wheel, a vitrified-bonded aluminum-oxide wheel of 180 to 220 grain size and Q hardness is recommended. The dressing wheel should be rotated at approximately 5000 surface feet per minute while the diamond wheel is revolved slowly by hand. The dressing wheel is reciprocated slowly across the face of the diamond wheel (see Fig. 4), and can be fed in about 0.0002 inch per pass to compensate for its fast breakdown. Not more than 0.003 to 0.005 inch of abrasive should have to be removed from the grinding wheel to correct the form and provide a clean cutting surface.

Diamond wheels should not be removed from the adapter on which they are mounted until the wheel is worn out. The run-out of the wheel when in use on the machine should not be greater than 0.0003 inch.

Recommended Speeds and Feeds

A surface speed of approximately 6000 feet per minute is recommended for diamond wheels when sharpening hobs, while slower speeds, ranging from 5000 to 5500 surface feet per minute, may be employed with aluminum-oxide wheels. Means should be provided on the sharpening machine for changing the wheel speed to compensate for changes in the diameter as the wheel wears away.

In sharpening carbide-tipped hobs, feeds of 0.0004 to 0.0006 inch per revolution are recommended for roughing, and 0.0001 to 0.0003 inch per revolution for finishing. With high-speed steel hobs, however, higher feed rates—from

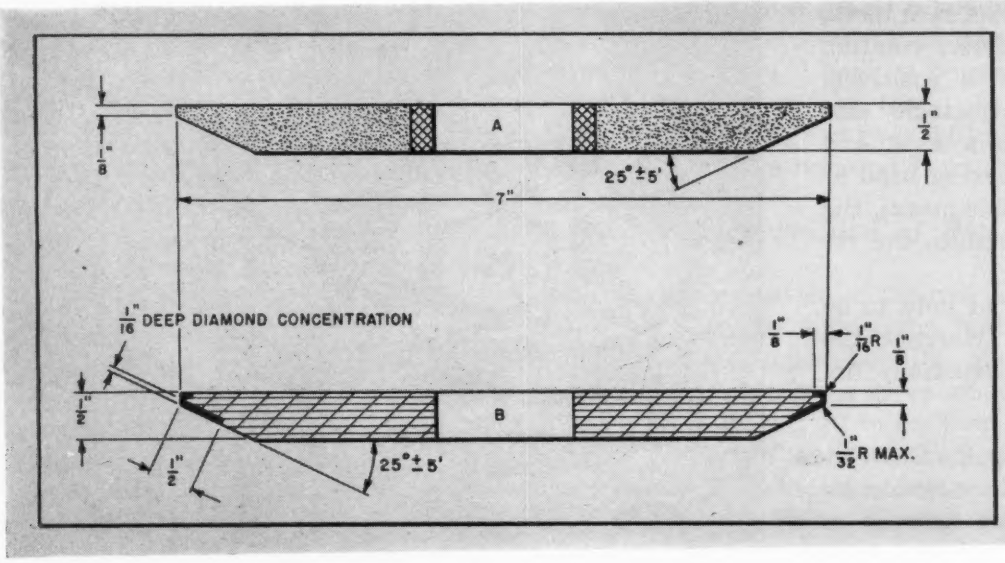


Fig. 3. Flat Grinding Wheels with Formed Face Recommended for Hob Sharpening. An Aluminum-oxide Wheel is Shown at A and a Diamond Wheel at B

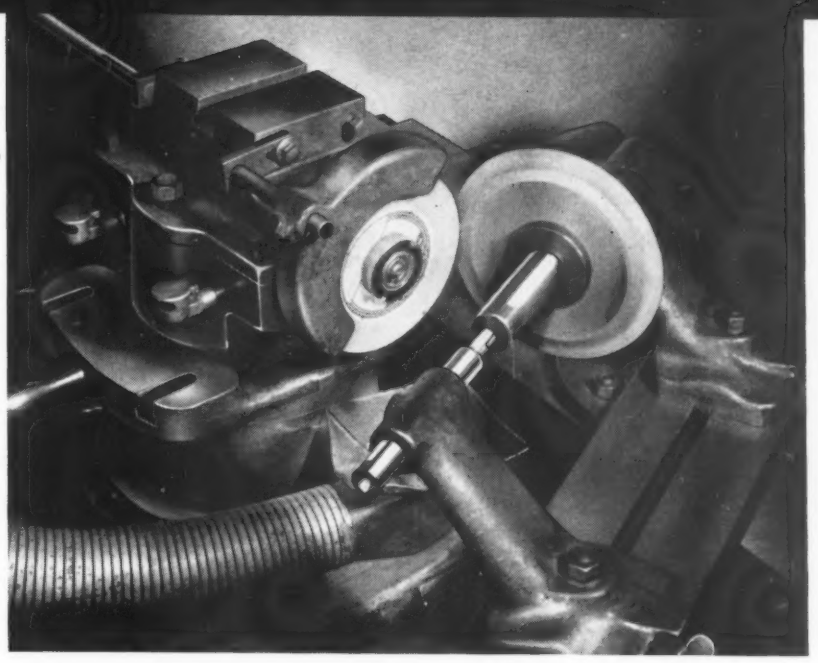


Fig. 4. Set-up for Truing a Diamond Wheel. The Diamond Wheel, Mounted on Its Adapter, is Removed from the Sharpening Machine and Dressed with an Aluminum-oxide Wheel, Seen at the Left

0.0008 to 0.001 inch per revolution—are suggested for rough-sharpening operations, and from 0.0005 to 0.0007 inch per revolution for finishing. On certain high-speed steel hobs, using a properly dressed wheel of correct specifications, roughing feeds as high as 0.005 inch per revolution have been successfully employed.

Excessive stock removal rates should be avoided, especially in grinding the fillet at the base of the gash. "Sparking out," which consists of making several passes through each gash without feeding the work, is recommended as a final operation in the sharpening of hobs to impart a good surface finish to the teeth.

Table speeds of 80 to 320 inches per minute are recommended, depending upon the material being ground and the surface finish desired. For high-speed steel hobs, a roughing speed of 140 to 200 inches per minute and a finishing speed of 80 to 140 inches per minute are recommended.

To sharpen carbide-tipped hobs, higher table speeds, ranging from 260 to 320 inches per minute for roughing and from 200 to 260 for finishing, are suggested. Although a slower speed will provide a finer surface finish on the hob teeth, too slow a speed will cause an excessive amount of heat to be generated.

Use of Coolant in Sharpening

Heat generated during the sharpening operation may cause surface burns and start cracks at the roots of the hob teeth. Since the temperature attained may reach 1500 degrees F., which is sufficient to anneal high-speed steel hobs, a coolant or a relatively light feed should be employed.

The use of a coolant is practically a necessity in sharpening carbide-tipped hobs, and on steel hobs, its use results in better surface finishes, longer wheel life, and minimum heating, thus preventing checking, cracking, or breaking-off of teeth. The coolant used should flood both the grinding wheel and the hob. It should clean the wheel by removing loose abrasive and absorb the generated heat.

For sharpening high-speed steel hobs, a water-

Fig. 5. The Conical Surface of the Grinding Wheel is Always Used for Sharpening Helical-gashed Hobs to Prevent Interference of the Wheel with the Hob Teeth

soluble grinding fluid, such as Microgrind 71, in the ratio of one part to twenty parts of water, by volume, has been found satisfactory. A good grade of grinding oil having a Saybolt universal viscosity of 150 to 190 at 100 degrees F. is suggested for sharpening carbide-tipped hobs. The coolant should be kept clean; otherwise, a poor surface finish will be produced on the hob teeth.

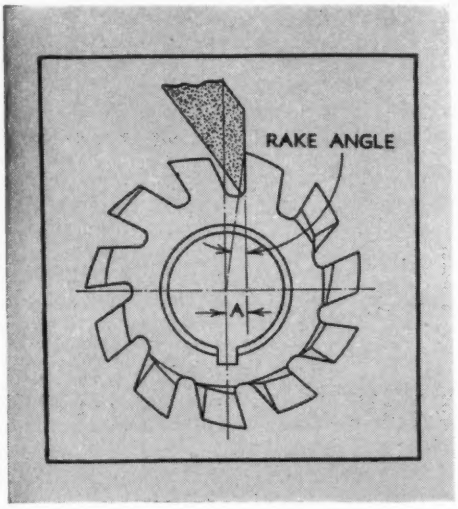


Fig. 6. To Sharpen Hob Teeth Having a Rake, the Conical Face of the Grinding Wheel is Offset a Distance A from the Center Line of the Hob

Methods of Sharpening Hobs

Cutting faces of straight-gashed hobs can be ground with either the straight face or the conical side of the wheel, although sharpening with the conical side is preferable. When the straight face of the grinding wheel is in the center of the hob, the feeding pressure is distributed over a maximum area on the hob teeth. However, when the wheel is at either end of the hob, surface contact between wheel and hob is considerably less. Obviously, then, since the feeding pressure is not changed, the pressure per square inch of surface contact is greater. Thus, if the feed is sufficient, more material will be removed from the teeth at the ends of the hob than from those in the center. Grinding with the conical surface of the wheel helps to keep the area of contact between wheel and hob uniform from one end of the hob to the other.

Helical-gashed hobs should always be sharpened with the conical surface of the grinding wheel, as shown in Fig. 5, because the straight side would interfere with the helix and produce a curved cutting face. The conical surface of the wheel, on the other hand, will clear the helical surface of the flute, and interference will not be experienced except on hobs having very high helical-gash angles.

Built-in diamond-wheel dressers are generally provided on automatic hob-sharpening machines for cutting a straight line of contact on the grinding wheel to produce radial faces or a given offset on straight-gashed hobs. A dresser has also been designed by the Barber-Colman Co. to generate a curved form on the grinding wheel for sharpening the teeth of helical-gashed hobs with or without rake. The dresser is placed on the machine in the same position as the hob to be sharpened. When the diamond is moved along the helicoidal paths of the gash to be sharpened, it generates a form on the grinding wheel which will, in turn, reproduce an accurate helicoid on the hob.

The grinding wheel should travel all the way across the faces of the hob teeth. Care must be taken in sharpening to remove an equal amount of metal from each row of teeth. Teeth not ground back as far as others will be higher, and therefore will result in irregular cutting action, the production of unsymmetrical gear teeth, and excessive wear of the higher hob teeth.

Although not recommended, it is sometimes necessary to sharpen unground hobs with unequal spacing between the flutes to take care of any distortion caused by hardening and make the diameters run true. On ground hobs, however, unequally spaced flutes cause high and low cutting edges, which produce unsymmetrical tooth forms. Unequal spacing

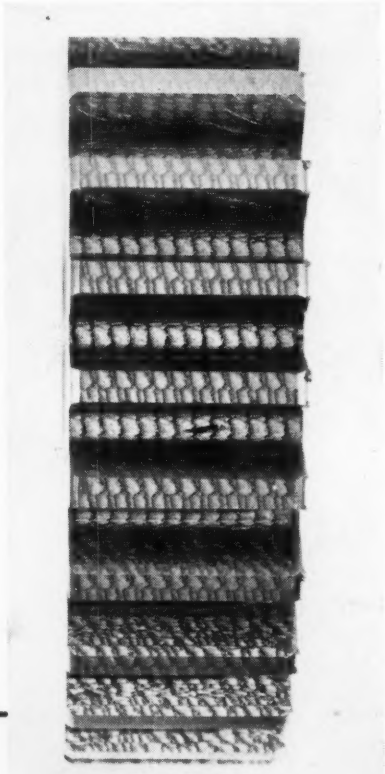


Fig. 7. Example of Poor Finish Produced on a Gear by an Improperly Sharpened Hob. Marks are Caused by Chips Clinging to Hob

Fig. 8. Method of Checking the Spacing of Gashes on Straight-gashed Hobs when Master Index-plates are Not Available

is usually caused by worn plates or pawls on the indexing mechanism, the removal of different amounts of metal from successive teeth, out-of-round arbors, or improper methods of mounting and locking the hob on the arbor.

When material is ground from the face of the teeth during sharpening, the depth of gashes may be decreased or the fillets increased, provided the fillet will not interfere with the form of the hob teeth. Generally, greater care should be exercised in sharpening hobs having more than one thread. For example, a high and low tooth condition will be aggravated by the fast lead on a multiple-thread hob.

To sharpen straight- and helical-gashed hob teeth having rake, the conical face of the grinding wheel must be offset from the center line of the hob a distance *A*, Fig. 6. Here

$$A = \frac{D}{2} \times \text{sine of rake angle}$$

where

A = amount of wheel offset, in thousandths of an inch; and

D = diameter of hob, in inches

Surface Finish Desired on Hob Teeth

Fine surface finish on the cutting faces of the hob teeth generally results in longer hob life, because the smoother surface offers less resistance to the curl of the chip during hobbing and reduces the frictional heat generated and consequent burning of the cutting edges. A surface finish of 10 to 20 micro-inches r.m.s. is recommended for precision steel hobs used for finishing, and from 5 to 10 micro-inches for carbide-

Recommended Tolerances for Sharpening Standard Hobs

	Class	Diametral Pitch								
		1 to 1 3/4	2 to 2 3/4	3	4	5	6 to 12	13 to 29	30 to 50	51 and Finer
Run-out of Hob, Measured at Maximum Circumference	A	0.003	0.002	0.0015	0.0015	0.001	0.001	0.001	0.0007	0.0005
	B	0.004	0.003	0.0025	0.002	0.0015	0.0015	0.001	0.0007	0.0005
	D	0.010	0.008	0.007	0.006	0.005	0.004	0.003	0.0015	0.001
Spacing from Flute to Flute	A	0.004	0.003	0.0025	0.002	0.0015	0.001	0.001	0.001	0.001
	B	0.006	0.005	0.004	0.003	0.002	0.001	0.001	0.001	0.001
	D	0.009	0.007	0.006	0.005	0.003	0.002	0.002	0.0017	0.0017
Spacing Error Accumulated in One Revolution	A	0.010	0.009	0.008	0.007	0.005	0.003	0.003	0.002	0.0015
	B	0.012	0.010	0.009	0.008	0.006	0.005	0.004	0.0025	0.002
	D	0.030	0.025	0.020	0.015	0.010	0.008	0.007	0.004	0.003
Cutting Faces Must be Radial within	A	0.003	0.0015	0.001	0.0008	0.0006	0.0005	0.0003	0.0003	0.0003
	B	0.005	0.0025	0.0015	0.001	0.0008	0.0007	0.0005	0.0005	0.0005
	D	0.010	0.0075	0.005	0.004	0.003	0.002	0.0015	0.001	0.001

All dimensions in inches.

tipped hobs. The finish obtained depends on the grinding wheel, coolant, table speed, and feed employed. A slower table speed is sometimes used for the finishing cut to obtain a fine finish.

Rough grinding wheel marks left on the faces of the hob teeth will cause chips to cling to the faces and load the gashes, resulting in premature dulling of the hob and a poor finish on the gear teeth being cut. Fig. 7 clearly illustrates the poor finish produced on a gear by a hob that has chips clinging to the cutting edges. The grinding wheel should be allowed to "spark out" at the end of the sharpening operation by traversing the work past the wheel once or more, with little or no feeding pressure on the wheel.

Burrs produced on the cutting edges of hob teeth during sharpening are usually the result of employing an improper wheel or too heavy a feed. Hobs having such burrs will produce incorrectly formed teeth until the burrs have been worn away. When the hob is used to cut soft materials, the burrs may last for quite some time. A lower feed rate and a wheel having a more dense structure should be used to correct such a condition.

Inspection of Sharpened Hobs

Hobs should be inspected periodically during the sharpening process to insure removing sufficient stock to restore the original accuracy and to prevent grinding an excess amount of material. The cutting faces of carbide-tipped hobs should be inspected frequently by means of a magnifying glass to be sure that all the minute cracks are being removed.

About 75 per cent of the hobs in use today are of the straight-gashed type. Such hobs can be inspected on bench centers by means of a dial indicator and gage-blocks. Spacing of the gashes is generally checked by means of master index-plates. When master index-plates are not available, a hob having an even number of gashes can be checked by placing one cutting edge of the hob on a rest and the tooth diametrically opposite in contact with a dial indicator, as seen in Fig. 8. The dial indicator is set at zero, and the hob is rotated to progressively inspect each pair of teeth. The spacing inaccuracy of each tooth is equal to one-half the reading on the indicator.

The lead of helical-gashed hobs is inspected on special test fixtures, such as the universal hob and worm checking machine made by Illinois Tool Works which is shown in Fig. 9. This machine checks the lead, the spacing of multiple-thread worms or hobs, and the hob-tooth or worm-thread profile. Also, by means of an electrical recorder seen at the right, it produces a tool graph or chart that shows the location of each tooth in relation to the other teeth and the desired lead helix.

Fig. 9. Universal Hob Measuring Machine being Employed to Inspect the Lead of a Helical-gashed Hob

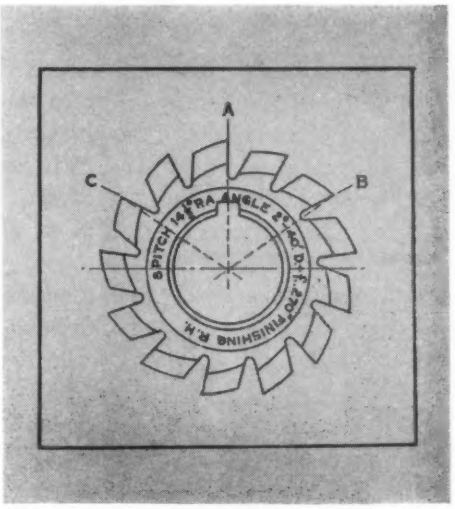


Fig. 10. Hob Teeth Designed without Rake Should Have Their Cutting Faces Radial, as Shown at A. Teeth Sharpened as Indicated at B or C on Hobs without Rake will Produce Incorrect Gear Tooth Form

Recommended tolerances to be employed in sharpening standard hobs having either a 14 1/2- or a 20-degree pressure angle are given in the accompanying table. Ground hobs are made with either Class A or Class B limits, the B limits being for commercial tolerances used in the manufacture of standard gears, while A limits are closer and are used for special work requiring greater accuracy. For hobs having a diameter larger than standard, sharpening tolerances should be increased to those given for the standard diametral pitch corresponding to that diameter. Tolerances for hobs having unground tooth forms are indicated by Class D. Spacing of the flutes on such hobs depends upon the amount of distortion caused by hardening.

Importance of Radial Cutting Faces

Teeth of correctly sharpened straight- or helical-gashed hobs without rake should have the cutting faces radial in planes passing through the axis of the hob, as shown at *A* in Fig. 10. Two common errors in sharpening such hobs are shown at *B* and *C*. Tooth *B* has been ground with an under-cut or positive rake which increases the length of the tooth face. Tooth *C* has been ground ahead of center, with a negative rake. Both teeth *B* and *C* will produce incorrect gear tooth forms; in the case of tooth *B*, a smaller pressure angle will result, while in the case of tooth *C*, a greater pressure angle will be produced. Such gear teeth, when meshed with teeth of correct form, will be noisy in operation and wear rapidly.

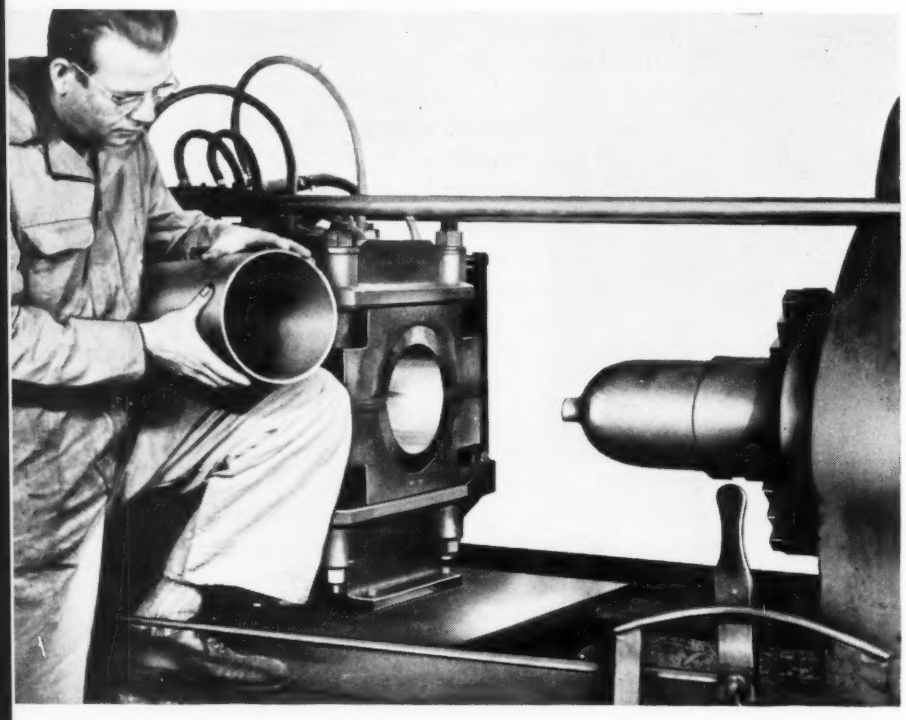
In straight-fluted hobs, the flutes are parallel to the axis of the hob. Flutes of helical-fluted hobs follow the lead marked on the ends of the hobs. When the cutting faces do not follow the desired lead, the hob becomes tapered, due to the back-off on the teeth, the lead is greater on one side and shorter on the other side, and the shape or pressure angle of each hob tooth changes.

Special hobs made with a positive or negative rake or hook are so designed that the correct pressure angle will be maintained when the hobs are properly sharpened. If the amount of rake on the hob is changed, however, an incorrect gear tooth form will be generated.

Preventing Run-Out of Hob

The bore and hubs of hobs are accurately machined to insure concentricity. To make certain that the hob will run true on the arbors of both hobbing and sharpening machines, a dial indicator should be mounted on the machine and placed in contact with the peripheries of both hubs. Run-out of the arbor itself should be determined before mounting the hob. Faces of the arbor spring collars must be parallel. Cleanliness and accuracy of arbor and collars are of utmost importance in hob sharpening.

Forming and Closing Tube Ends by



Tubular Products Can be Formed to Various Cross-Sections and Tube Ends Closed at High Production Rates and Low Cost by the New Westin Process, in which Heat is Applied to the Work During Forming by the Resistance of the Work to the Electric Current

TUBE reducing, necking, closing, wall thickening, and other forming operations are combined in the revolutionary new Westin metal-working process. The equipment required for this process consists essentially of a welding transformer *A*, Fig. 1, and a split forming die *B* to which electrical current is supplied by the transformer. The tube *C* to be formed is rotated and advanced into the die. The resistance of the tube to the passage of electric current from one die segment to another rapidly heats the tube, permitting it to be formed to the shape of the die cavity.

Applications of the process include the forming of gas containers, upsetting of tubes to increase their wall thickness, sealing of tube ends, necking of tubes, forming of shells, and forming operations on conveyor rolls, propeller shafts, axle housings, and similar products. A few examples of parts formed in this way are shown in Fig. 2.

Materials that have been formed up to the present time by this process include the entire range of carbon steels; most alloy steels, including stainless steels; copper alloys, such as brass and bronze; and aluminum. However, it is believed that the process is not limited to these materials, but can be applied to practically any metal that will conduct electrical current.

Tubes ranging from 1/16 to 3/8 inch in wall thickness and from 3/4 inch to 16 inches in diameter are considered to be within the practical forming limits of this process. Here again, however, no definite limits can be specified, since tubes 18 5/8 inches in diameter with a 3/16-inch wall thickness and tubes 9 5/8 inches in

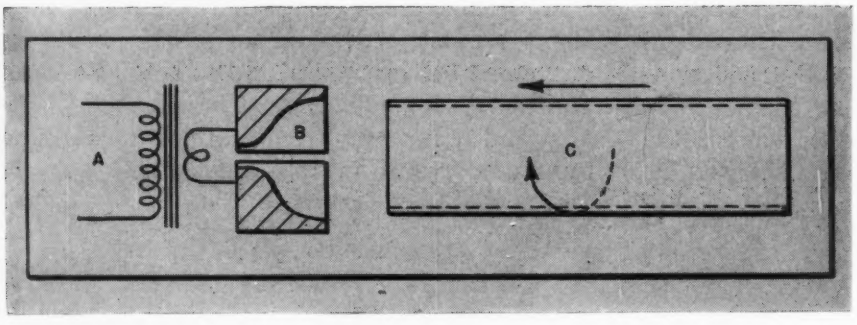


Fig. 1. Transformer A Supplies Current to Split Die B, which Heats and Forms Tube C as Tube is Rotated and Advanced into Die

a New Process

By ARTHUR L. WILLIAMS, Chief Engineer
The Federal Machine & Welder Co.
Warren, Ohio

diameter with a 1 1/8-inch wall thickness have been successfully formed. The use of removable dies permits a wide range of tube sizes to be formed on one machine. Three standard size machines are available for handling tubes ranging in diameter from 3/4 to 4, 4 to 8, and 8 to 16 inches.

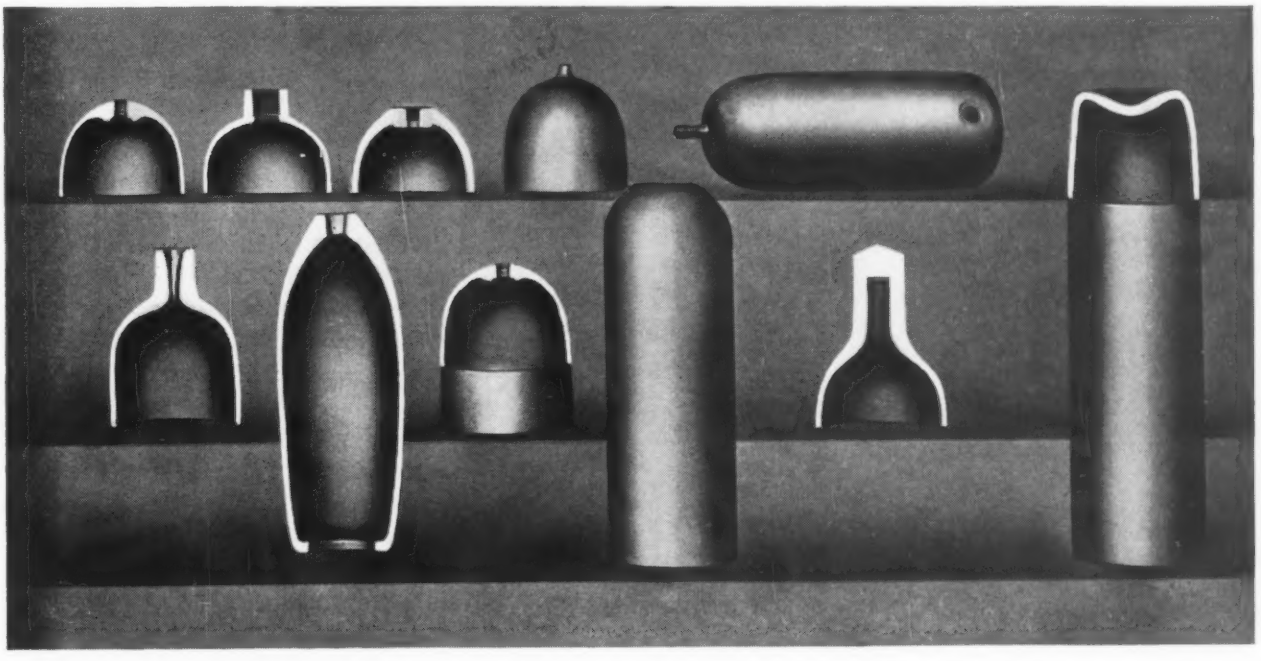
In certain instances, tubes are being formed at from three to four times the production rates previously obtained by flame spinning or cold friction forming. The speed of the process is limited only by mechanical considerations, such as the time required for loading and unloading, and by the amount of electric power and hydraulic pressure (for forcing the tube into the die) that is available.

For example, the forming of one end of an SAE 1020 steel tube to a bottle-neck shape, as seen at the lower left-hand corner of Fig. 2, required a peak electrical demand of 208 KVA, with a power factor of 92, the power being applied for 5.6 seconds. The tubes had an outside diameter of 3 1/2 inches and a wall thickness of 1/8 inch, the amount of metal formed being 3.77 cubic inches. The tube was fed into the die at the rate of 30 inches per minute, utilizing a total hydraulic pressure of 25,000 pounds. A production rate of 180 tubes per hour was obtained including loading and unloading time.

A similar forming operation on tubing having an inside diameter of 14 1/2 inches and a wall thickness of 0.240 inch required a heating time of 34 seconds, with a peak demand of 1000 KVA. These and other tests indicate that the electrical power requirements are directly proportional to the cubic inches of material to be formed, the ratio being approximately 55 to 1. Slightly more power may be required to heat large-diameter, thick-walled tubes, while less may be needed for small-diameter, thin-walled parts. In instances of high electrical power requirements, the die can be split into three segments, allowing equal loading of each phase of the conventional three-phase power supply system.

For two-segment dies, a 440-volt 60-cycle, single-phase supply current is employed. A secondary current of 60,000 to 70,000 amperes at 4 to 6 volts is obtained from the heating transformer. Operator safety is insured by using such low-voltage, high-amperage current. Since the forming temperature can be accurately controlled and is always maintained below the critical point of the material being worked, a subsequent

Fig. 2. Examples of Parts Produced by the Westin Tube-forming Process. Steel, Copper, Aluminum, and Other Alloys Can be Formed



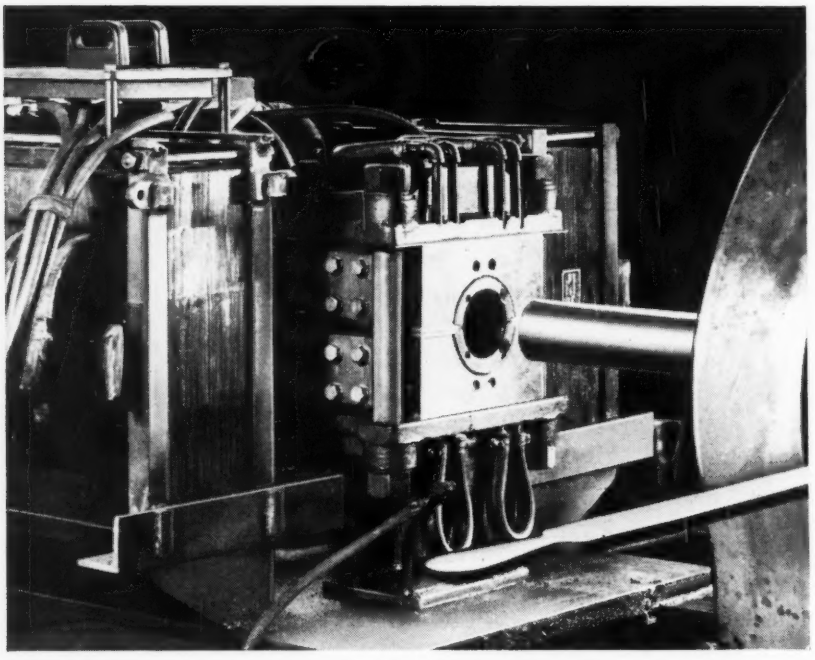


Fig. 3. Two Heating Transformers, Each Rated at 125 KVA, are Provided on This Pilot Tube-forming Machine. One is Located on Each Side of Split Die

annealing operation—generally required after other tube-forming methods—is unnecessary. The low-temperature, even heating prevents work-hardening or the setting up of strains within the metal. Frictional heat is maintained at a minimum by rotating the work slowly, at about 57 R. P. M.

A pilot machine, Fig. 3, has been set up in the plant of the Federal Machine & Welder Co. for demonstration and experimentation. Two 125-KVA heating transformers are employed, one on each side of the split die. The two die segments each consist of a bronze alloy (40 per cent copper) block, which holds a special tool-steel insert. The forged inserts have a Brinell hardness of about 400, and, in cases of severe forming, are sometimes faced with Stellite wear strips. The two halves of the split die are in-

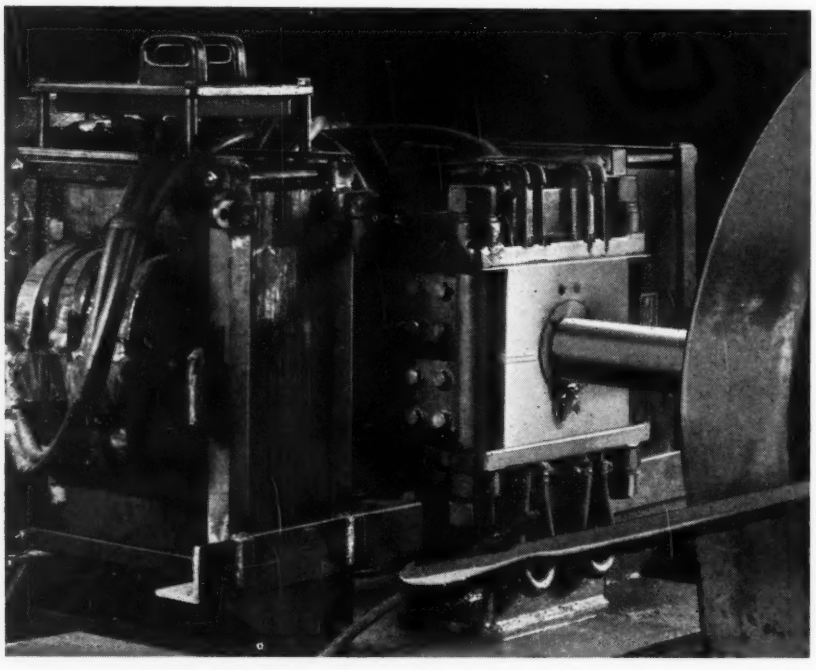


Fig. 4. The Die-head is Advanced Hydraulically until Contact is Made between Tube and Die. Power is then Supplied to the Die for Heating the Tube

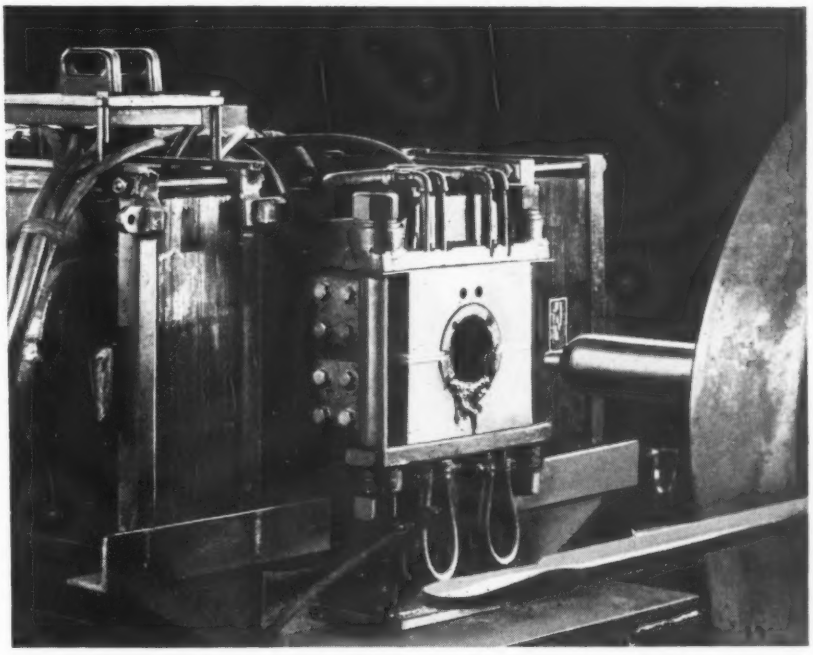


Fig. 5. Completely Formed Tube is Shown Here with the Die-head Retracted. Time for Loading, Forming, and Unloading This Part was Twelve Seconds

sulated from each other by stainless-steel reinforced mica sheets. Limited tests have indicated an exceptionally long life for such dies.

One of the water-cooled die-blocks is directly connected to one lead from each heating transformer. The other die-block is connected to the other lead from each transformer. The tube to be formed is clamped in a conventional chuck and rotated at about 57 R. P. M. The die-head is advanced hydraulically toward the tube, as seen in Fig. 4, until a good contact is obtained between the tube and the die. Power is then supplied to the transformers, and current flows from one die segment, through the tube, and back to the transformers through the other die segment.

Resistance of the tube to the flow of current causes it to rapidly become heated, and as the die continues to be fed toward the tube, the tube is progressively formed to the shape of the die cavity. A completed tube is seen in Fig. 5 after the die-head has been retracted to its original position. A special high-temperature graphite lubricant, carried in oil, is applied to the periphery of the tube before forming.

When extremely close tolerances must be maintained on the formed wall thickness, a mandrel can be placed in the center of the die, or of the chuck and tube, to limit the diameter to which the inner wall of the tube is reduced. For high-production applications, loading, operation, and unloading of the machine can be accomplished automatically.

Laminated tubes or steel tubes having a liner of stainless steel or other material can be readily formed by the process described. It is also possible to form an assembly having a threaded bore or projection by placing a bolt or nut in the die-head and forming the tube around it.

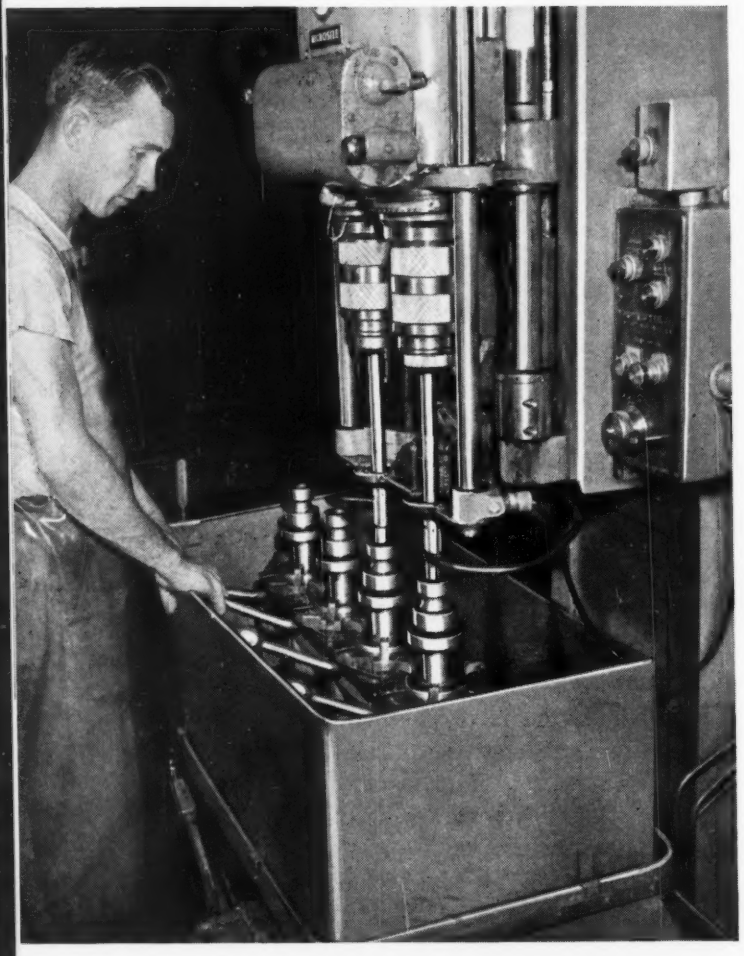
Certain extruding operations can be performed by modifying the process. By stopping the rotation of the chuck while still forcing the tube through the die, the hot metal will be forced into the openings between the die segments, thus forming longitudinal fins on the periphery of the part.

Quality of the product formed is accurately controlled, and rejections are few. A scale-free, smooth surface is produced, and no porosity has been found on samples that have been sectioned. The seam on welded tubing remains straight after forming, indicating that there is no twisting during the operation.

The patented Westin process, available under license from the Federal Machine & Welder Co., opens new possibilities in the metal-working field. Certain deep-drawing operations can be eliminated, and some articles previously made from sheet-metal stampings can now be fabricated more economically from tubing. Soldered, brazed, or welded joints can be eliminated on containers that have to be closed at both ends.

Gear Production Speeded up by Honing

By WILLIAM H. CORTWRIGHT
Master Mechanic
Warner Gear Division
Borg-Warner Corporation



SEVERAL innovations have been introduced in the gear manufacturing methods employed at the Warner Gear Division of the Borg-Warner Corporation, Muncie, Ind., that have greatly increased production. For example, by honing the bores of cluster gears for automotive transmission countershafts before hardening, the rate of production has been more than doubled. In addition, the concentricity of the bores with relation to the pitch diameters of the teeth has been considerably improved. Also, the production of helical splined rings has been doubled by the use of an unusual broaching machine.

The bores of certain gears are honed before hardening so that the gears can be located from the accurately sized, round bore while teeth are cut on the periphery. This insures concentricity of the bore with relation to the pitch diameter of the gear teeth, and is specially advantageous in the manufacture of wide gears or cluster gears, where run-out and taper are troublesome.

Forged SAE 4620 steel cluster gears for automotive transmission countershafts, after they have been drilled, broached, and turned, are honed on the two-spindle Micromatic honing machine seen in Fig. 1. A four-station, lateral indexing fixture is employed for honing the bores of two gears at a time. Two honed gears are unloaded, and two other gears are loaded during the honing operation, a production of 100 per hour being attained. The gears are located vertically from their large faces, and are clamped on their flanges by lever-actuated fingers.

From 0.004 to 0.0055 inch of stock is honed from the 1-inch diameter broached hole in this

Fig. 1. (Above Left) Forged Steel Cluster Gear Blanks for Automotive Transmission Countershafts are Honed to Permit Accurate Location while Cutting the Teeth

Fig. 2. (Left) After Cutting the Teeth and Hardening, the Bores of the Cluster Gears are Finish-honed to Correct Distortion and Produce the Desired Finish

before Hardening and Spline Broaching

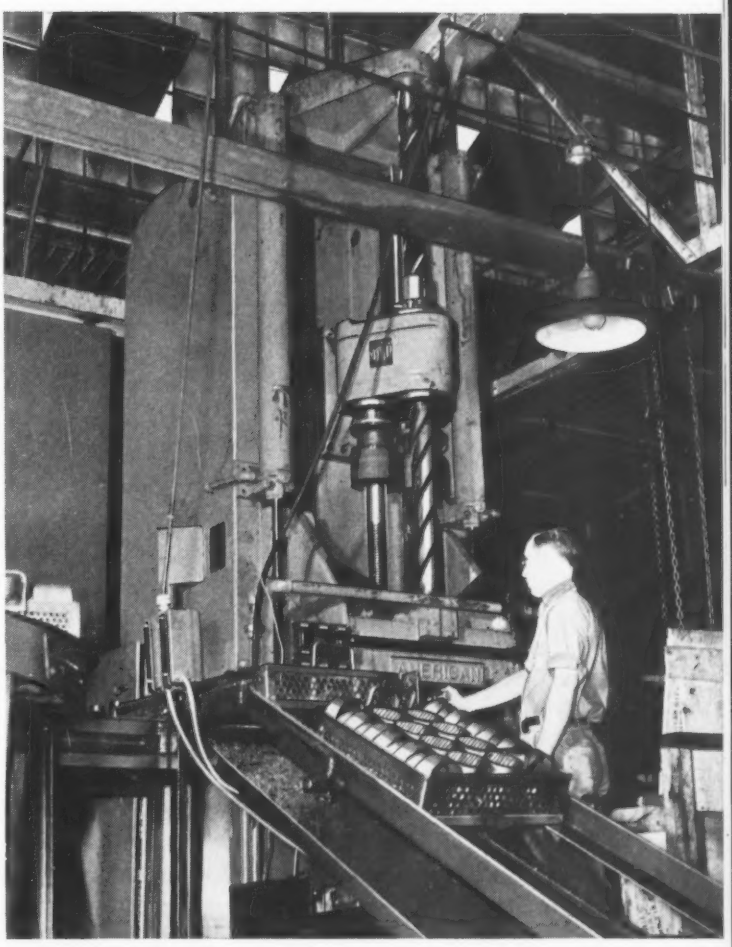
so-called "green" honing operation. Automatic electronic sizing is employed on the machine to hold the bore size within 0.0003 inch. The honing stones consist of 220-grit aluminum-oxide abrasive grits, held together in stick form by a vitrified clay bond. A sulphurized mineral-base oil, mixed with a kerosene base, is employed as the cutting fluid.

After "green" honing, teeth are cut in the periphery of the cluster gears. The parts are then hardened, and the bore is finish-honed on the two-spindle Micromatic machine seen in Fig. 2. Finish-honing is required to correct any distortion caused by hardening and to produce the desired finish.

From 0.0013 to 0.0028 inch of stock is removed in the finish-honing operation, and the bore size is held within ± 0.0005 inch. A closer bore tolerance is maintained in "green" honing to minimize the run-out on the pitch diameter of the teeth during gear-cutting. A rotary table holding four free-floating fixtures is employed, the production obtained with this set-up being 120 cluster gears per hour. The gears center themselves on the honing tools, so that location of the bore with relation to the teeth is not changed. Automatic double indexing positions two of the fixtures in the loading and unloading stations at the front of the machine while the other two fixtures are under the honing spindles.

Previous methods of manufacturing these gears did not include "green" honing or finish-honing. The bores of the cluster gears were ground after gear-cutting and hardening by locating from the gear teeth. Production obtained in this way was only 25 per hour.

Helical involute splines are broached in the bore of ring blanks for automotive transmissions at the rate of 100 per hour on the machine shown in Fig. 3. The internal helical-splined parts are produced at twice the rate previously obtained by conventional cutting methods. This



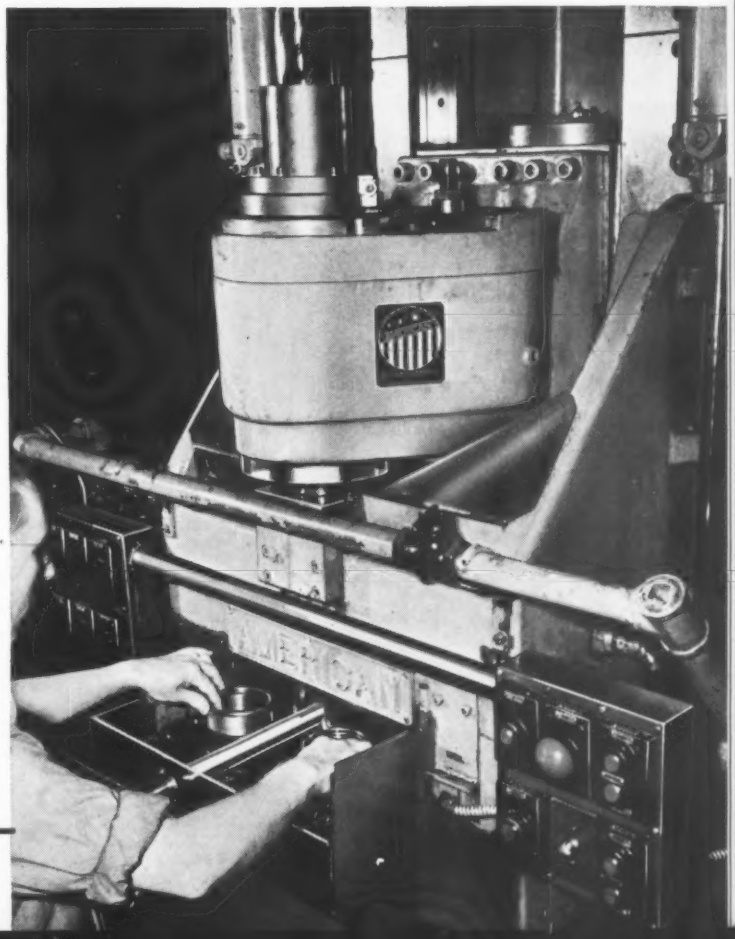


Fig. 3. (Above Right) Pull-up Type of Broaching Machine Having a Vertical Lead-screw that Rotates the Two Broaches During the Up Stroke to Produce Helical Splines

Fig. 4. (Right) Loading Two Ring Blanks into Shuttle Fixture for Broaching Helical Involute Splines in the Bores on 30-ton Hydraulic Broaching Machine Seen in Fig. 3

large pull-up type vertical broaching machine, built by the American Broach & Machine Co., has a normal operating capacity of 30 tons and a broaching stroke of 60 inches. The double-spindle, single-ram, hydraulically-operated machine has a height of 16 feet 10 inches.

Two ring blanks are broached at a time, the parts being first loaded into a shuttle fixture, Fig. 4, while the two broaches rest in the lower guide. After the shuttle has been manually slid into the broaching position, the operating push-button control is depressed to start the machine cycle. The two broaches, approximately 3 3/4 inches in diameter by 70 inches long, are raised by the lower guide until the upper shank ends come up through the blanks and are connected to the automatic broach pull-heads.

The main machine ram then starts on the upward broaching stroke, while the lower guide continues moving upward to keep the broaches in alignment during the cutting cycle. A vertical lead-screw is provided on the machine, as seen in Fig. 3, to rotate the broaches during their upward stroke and thus produce the helical involute splines in the bores of the blanks. The gear blanks are shown in Fig. 5 before and after broaching.

When the two broaches reach the top of the stroke, the operator unloads the two splined parts from the shuttle fixture, and then starts the ram downward to return the broaches to their starting position in the lower guide. The complete cycle time is about 0.85 minute for machining two parts. Actual broaching time is 0.38 minute, while the fast broach return stroke requires 0.23 minute. A conveyor removes excess chips from the coolant reservoir.

Pinion gears for an automotive over-drive unit are automatically fed into a gear-shaving machine by means of the gravity loading mechanism seen in Fig. 6. This mechanism, developed by the National Broach & Machine Co. for use on the "Red Ring" shaving machine, employs an air-operated loader to carry each gear from a gravity magazine to the shaving position. The production from two machines, with one operator, is 2300 gears in eight hours.

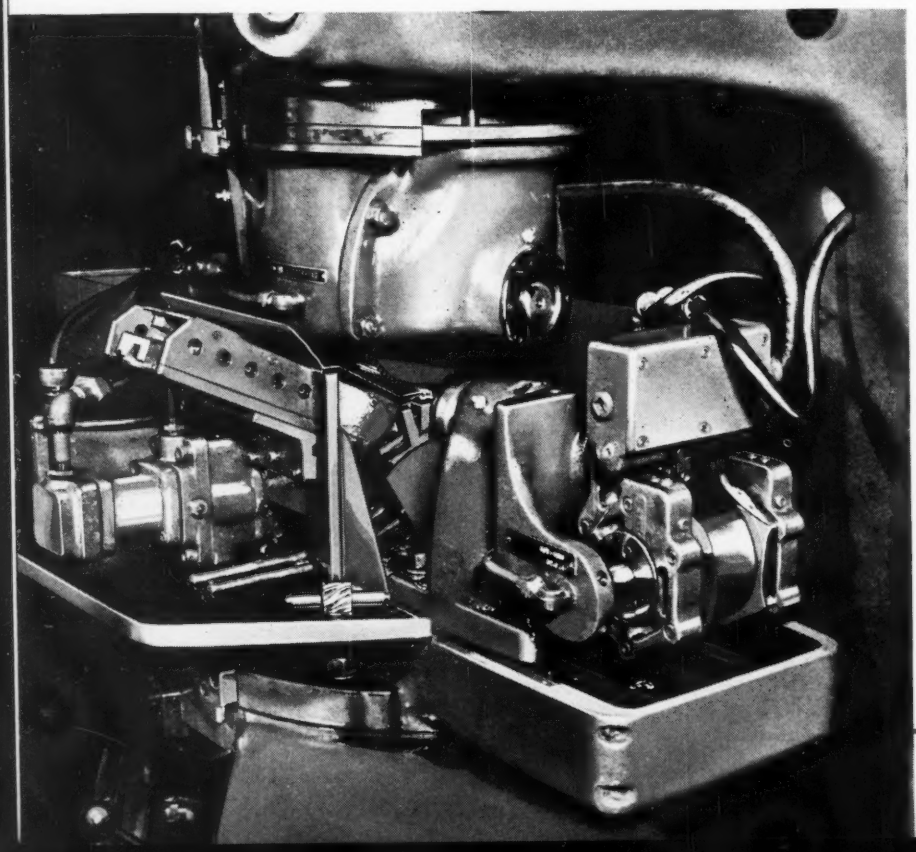


Fig. 5. (Above) Automotive Transmission Member Containing Helical Involute Splines that is Broached from a Ring Blank at the Rate of 100 per Hour

Fig. 6. (Left) Gravity Loading Mechanism for Automatically Feeding Pinion Gears into a Gear-shaving Machine. Shaved Gears are Automatically Ejected

British Industrialists and Workers Coming to Study Our Methods

BETWEEN two and three hundred workers and management personnel from British industrial plants will soon visit America to learn how we have achieved our high production efficiency. These men will be selected from all levels of production and from both large and small plants in a variety of industries. Tours of different plants will be arranged by the Anglo-American Council on Productivity, which was established under the auspices of the Economic Cooperation Administration.

Investigations have established the claim that the tempo of the British workers is every bit as fast as that of American workers. Thus the fact that the output of the average American workman is nearly double that of the British worker appears to be due mainly to the lack of modern machinery and tools, good plant facilities, and efficient production methods.

American plant visits should give our British friends plenty of "know how." When they leave our shores, they should possess considerable knowledge of the means by which their country can again attain economic sufficiency. That can come through wise use of the money made available to Great Britain under the Marshall Plan in the purchase of high-production types of machine tools and other manufacturing equipment. It is to be hoped that the British Government and its businessmen and workers will make every effort to put into effect the recommendations of their fellow-countrymen.

American industrialists should cordially welcome these visitors and cooperate with them to the fullest possible extent without divulging details of technique that may give individual companies manufacturing advantages over competitors. Our businessmen should bear in mind the fact that the sooner European nations become able to support themselves, the sooner material shortages will end in this country, and the sooner taxes can be reduced that are now necessary for fulfillment of the Marshall Plan. Great Britain hopes to be independent of outside aid by 1952.

It is especially gratifying to learn that British workmen will accompany management personnel on their tour. This indicates a desire on the part of British labor to cooperate in the development of faster production methods, and is in line with the statement recently made by W. Averell Harriman, United States special representative to Europe, that the willingness of trade unions in Europe to accept their full share of responsibility in European recovery has firmly assured success of the Marshall Plan.

The British workers should be given the opportunity to have intimate contact with our machine operators, not only to learn about individual manufacturing processes, but also to learn something about the high standards of living that go hand in hand with high production methods and free enterprise. May the British mission be eminently successful, both from their viewpoint and ours!

Charles O. Herb

EDITOR

Heat-Treating Department Planned

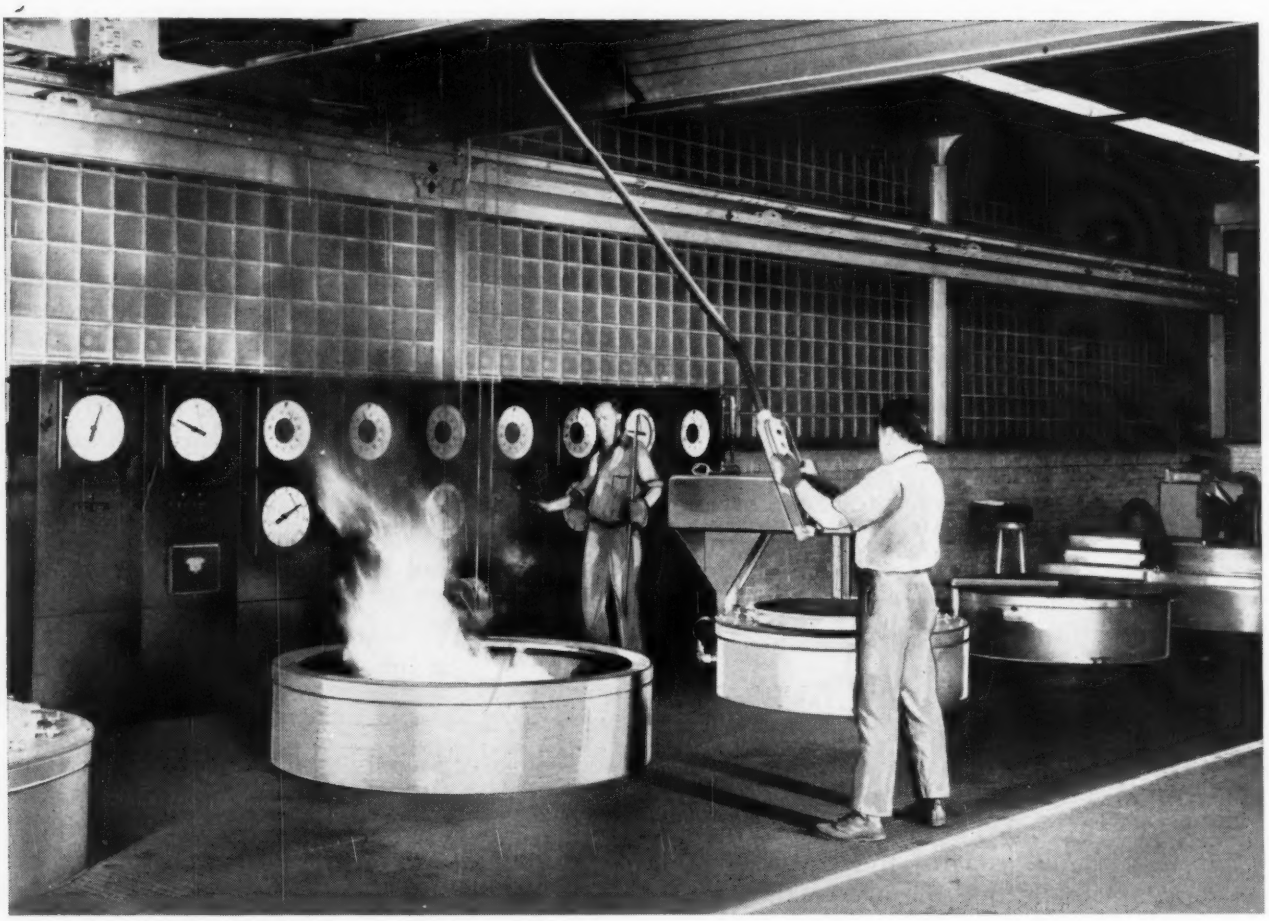


Fig. 1. General View of One Side of the Landis Tool Co.'s New Heat-treating Building, Showing the Glass-block Wall Construction and the Symmetrical Appearance of All Furnace, Quenching, and Degreasing Equipment

INCREASED control of quality and more efficient operation of manufacturing departments have been the objectives of the Landis Tool Co. in providing new and improved plant facilities. The latest project in the company's expansion program has been the erection of a building for the heat-treatment of a variety of parts for cylindrical grinding machines, such as wheel-spindles, master cams, shafts, spacing bars, and work centers. Owing to the close tolerances to which many of these parts are finished, uniform hardening of the work and the prevention of distortion during heat-treatment were prime considerations in planning the new department.

The heat-treating building is constructed of glass blocks extending from a 5-foot brick wall to the ceiling, so as to insure maximum daylight. Fluorescent lights are arranged in parallel the entire length of the ceiling to provide uniform lighting of the department on dark days and at night. An air-conditioning system gives a complete change of air every six minutes, so that a comfortable temperature can always be maintained.

Another feature of the heat-treating department is the symmetry of design of the heat-treating equipment. Pit furnaces and quenching and degreasing tanks are all of circular form, as seen in Fig. 1, and extend 18 inches above the floor level. The units are installed 2 1/2 feet apart and spaced equidistantly from the end walls on a straight center line. Solid steel decking, 1/4 inch thick, is provided around the furnaces and tanks, the remainder of the floor being concrete.

Air for ventilation of the department enters the basement through gratings, is drawn to the top of the building through air shafts in the wall at one end, and is then exhausted through Anemostat air diffusers in the ceiling. Heated air is withdrawn by a large fan at one end of the building. The building is 80 feet long by 60 feet wide.

for Quality Control and Cleanliness

By JOHN H. FISHER
Metallurgist
Landis Tool Co.
Waynesboro, Pa.

Fig. 2. Arrows Painted along the Crane Runway and on a Bracket Attached to the Crane Facilitate Exact Centering of Work above a Pit Furnace or Tank

Electrically heated furnaces built by the Lindberg Engineering Co. have been installed. In Fig. 1, a load of grinding wheel spindles has just been lowered into one of two pit type furnaces. To facilitate centering the work fixture above the furnaces, and also above the quenching and degreasing tanks, arrows pointing downward have been painted along the crane runway, as seen in Fig. 2. An arrow that points upward is provided on a bracket attached to one beam of the crane. When a load of work is being brought to either a furnace or a tank, it is an easy matter for the crane operator, by means of a pendent switch, to line up the crane arrow with the corresponding arrow on the runway. Thus the work fixture is brought directly in line with the center of the furnace or tank on an axis extending crosswise of the building. Centering of the work fixture with the furnace in a line extending parallel with the building is then accomplished by feeding the crane hoist toward the wall until the two light bulbs seen in Fig. 2 on the crane are flashed on. Then the work fixture is in the exact center of the furnace or tank.

This simple arrangement minimizes the time necessary to move the work from the furnace to the quench tank. Smoke which arises from the oil quench tank when quenching work is drawn up by a fan through the grating seen in the ceiling above the crane in Fig. 2, and exhausted through the roof of the building. The crane spans the entire shop, and has five speeds in all directions to permit, for example, a fast quench in the oil tank or the slow introduction of work into the vapor degreaser.

Safety measures were given careful consideration in planning this department. There are no protruding pipes around any of the equipment and there is no floor unevenness. All loading and unloading of work can be done in an open space away from the furnaces and transferred to and from them by crane.

If there should ever be a fire in the oil quenching tank, it could be quickly extinguished by carbon-dioxide gas supplied through five pipe nozzles of 2-inch size, which are provided around the inside of the tank, as seen in Fig. 3. All workmen are instructed to leave the department immediately in the event of a fire. They are also instructed to pull a handle beside one exit door, so as to release two cylinders of carbon-dioxide gas. The gas is delivered through the nozzles to the surface of the burning oil and puts out the fire at once.

Incidentally, the quenching tank is provided with two pumps capable of circulating 1100 gallons of oil per minute. The quenching tank is designed with an air space 4 inches wide around the entire circumference down which air is

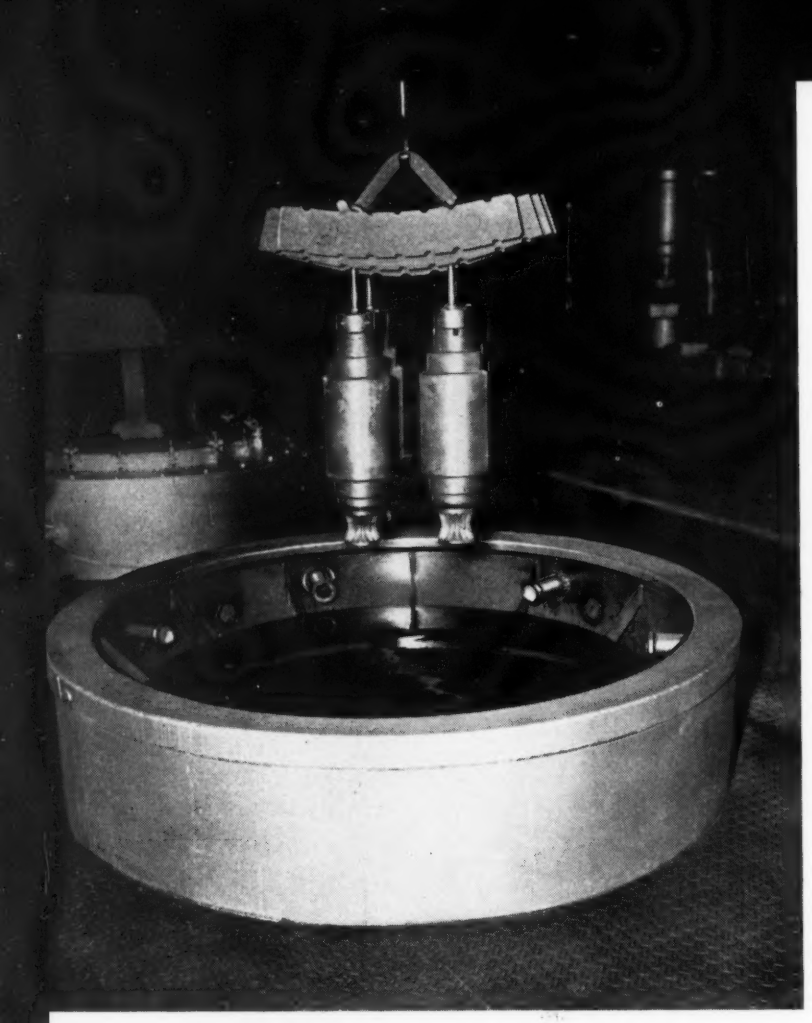


Fig. 3. View of the Oil Quench Tank Showing the Arrangement of Nozzles through which Carbon-dioxide Gas is Delivered in Case the Oil should Become Accidentally Ignited, to Put out the Fire

drawn by the ventilating system to remove all smoke arising from quenching operations.

The vapor degreaser tank is equipped with a swing cover, as seen on the second unit from the right in Fig. 1, which is operated by a foot-treadle. This cover is kept closed except when the crane is loading or unloading work. In Fig. 4 is seen a simple cover of split design provided on the cyanide bath. When there are no work baskets in the bath the cover halves are closed tightly.

Gas atmosphere is supplied to the heat-treating furnaces by a Lindberg Hyen gas generator in the basement of the building, with carburizing gas additions of bottled propane. One of the pit furnaces is 36 inches in diameter by 48 inches deep, while the other is 24 inches in diameter by 96 inches deep. The oil quench tank between these two furnaces has a depth of 10 feet. The use of a controlled gas atmosphere in heat-treating has obviated the need of packing work in carburizing compounds or cast-iron chips. Since a large portion of the steel used in Landis tool grinding machines is of tool steel quality, the surface of the parts must be protected during heat-treatment to prevent scaling, carburization, or decarburization. Obviously, the present method of suspending a group of parts from a fixture which is loaded directly into the pit furnace is a great improvement over the former method of heat-treating the parts, one at a time, in a horizontal furnace. From the time of first loading, through the quenching operation and the degreasing and tempering, the spindles remain on the fixture, and when unloaded are ready for inspection and finish-grinding. As all the work is suspended vertically during the heating cycle, the distortion problem is minimized.

The Brown Electronik recording and indicating pyrometers provided for all furnaces are mounted on a panel set against one wall, as seen in Fig. 1. This panel also contains all the control buttons for the furnaces, the quench tank, exhaust fans, and gas generator. By thus grouping the controls, the operator or foreman can see at a glance the progress of the work in all units of the department. The control buttons are provided with pilot lights, and each is labeled to indicate its purpose. At each end of the instrument panels are Flo-scopes for the atmosphere gas, placed at eye level.

The Blakeslee vapor degreaser removes the quenching oil from heat-treated work before the latter is placed in a Cyclone tempering furnace. This furnace is equipped with a support spider and adapter ring, so that fixtures coming from either of the two

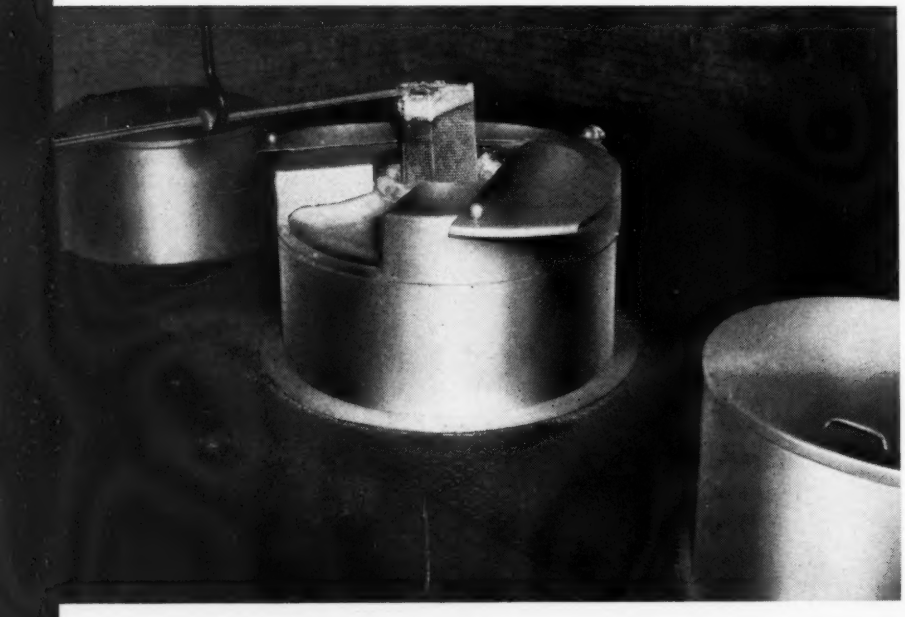


Fig. 4. A Split Cover on the Cyanide Bath Provides a Neat Means of Enclosing the Bath when It is Not in Use

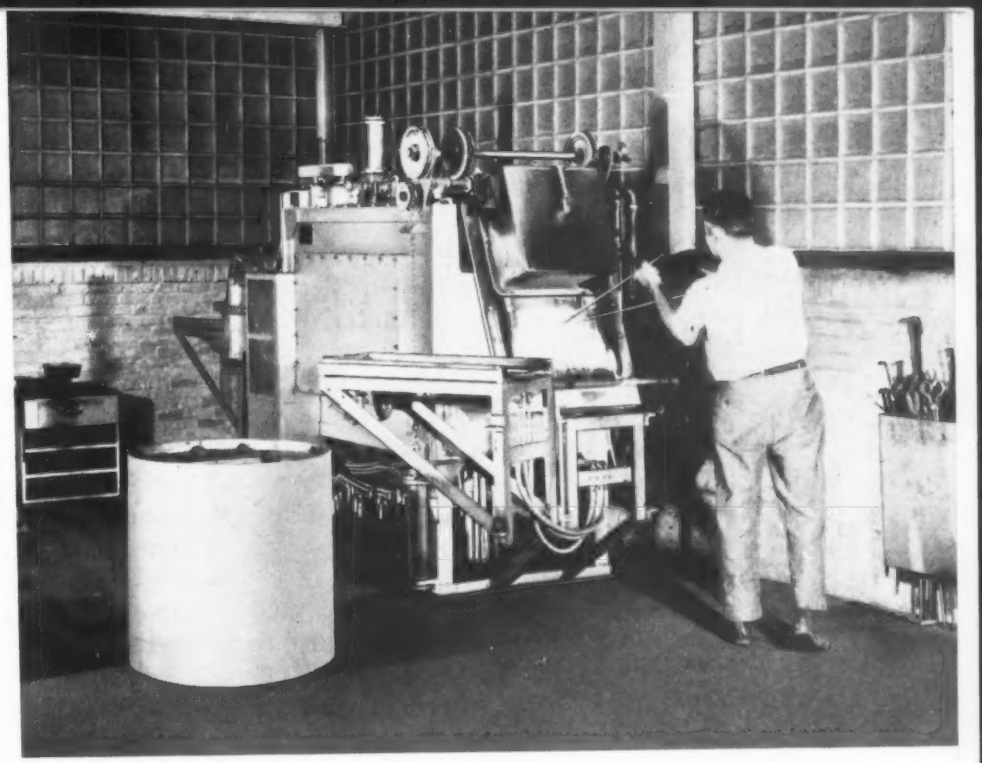


Fig. 5. Horizontal Hearth Furnace Equipped with Globar Elements which is Used for Heat-treating Small Tool-steel Parts and High-speed Steel Tools without Scaling or Decarburization

hardening furnaces can be accommodated with a minimum change.

The Globar-element horizontal hearth furnace seen in Fig. 5 is employed for heat-treating small tool-steel parts and high-speed steel tools under a controlled atmosphere, without scaling or decarburization. This furnace has a cooling chamber for cooling the work under gas atmosphere. The box tempering furnace that is seen beside the hardening furnace may be used to preheat work.

Machine spindles heat-treated in this department range from 3 1/2 inches in diameter by 1 1/2 feet long up to 8 inches in diameter by 10 feet long. They are generally made from S A E 6180 high-carbon chromium-vanadium steel. The heat-treating cycle on a typical lot of spindles is as follows: First the work is heated to 1300 degrees F. in order to stabilize and prevent distortion, this temperature being maintained for three hours; then the temperature is raised to 1600 degrees F. and the work is held at that temperature for another period of three hours; next the work is quenched in oil held at 110 degrees F. and cooled down; finally, after the spindles have been degreased, they are tempered at a furnace temperature of 400 degrees F. The length of time that a spindle is held at this temperature is based on a period of one hour for each inch of spindle diameter.

Another important job consists of heat-treating master camshafts of high-carbon, high-chromium tool steel, which is a non-shrinking type. The same general procedure is followed as in heat-treating spindles, except that in the hardening operation, the final step is to hold the spindles at a temperature of 1775 degrees F. for three hours.

Work centers made from both high-carbon, high-chromium steel and from manganese oil-hardening steel are also heat-treated in this department. Then, too, there is a great deal of gas carburizing performed in the box type, all-purpose brazing furnace and in the pit furnaces.

Part of one side of the building is provided with forging equipment, which includes a 300-pound Chambersburg air hammer and two American gas-fired cutlery forges. The entire building inside is aluminum painted.

* * *

The production of stainless steel has increased from 42,000 tons in 1929 to considerably over 600,000 tons in 1948.

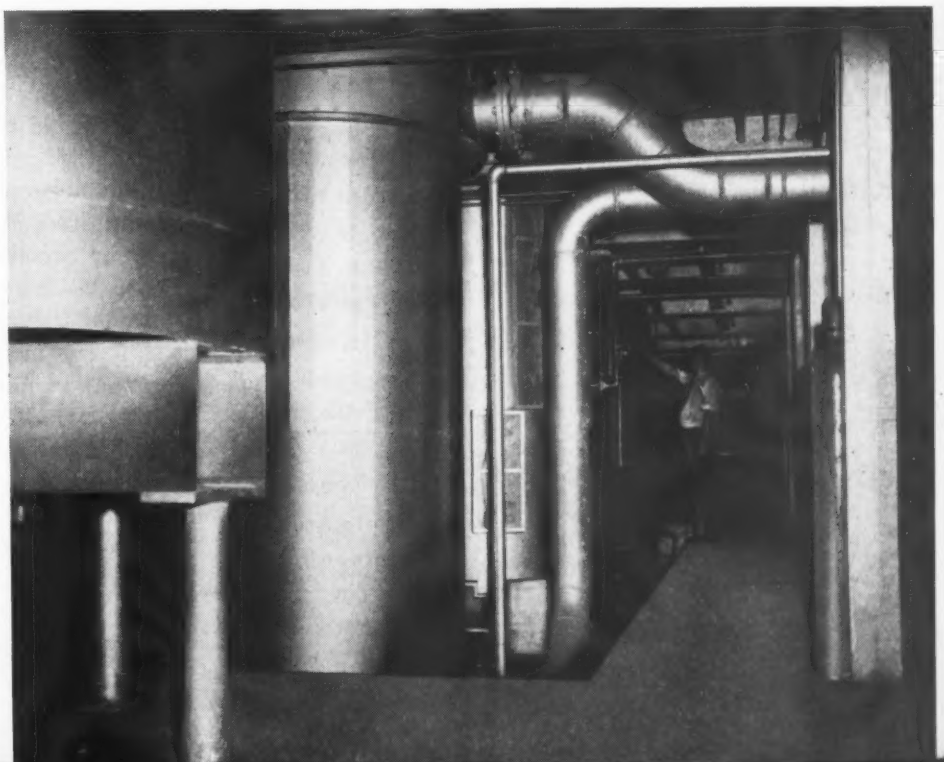


Fig. 6. View of Basement Area, Showing Lower Ends of Pit Furnaces and Quenching and Degreasing Tanks

Manufacture of Carbide Dies

FOR several years, carbide has become an increasingly important die material for the stamping, forming, and drawing of metals. Although the development of carbide dies has been rapid, their adoption has been retarded by the fact that many people still consider carbide a hard, brittle material that cannot be machine-ground and will not resist shock or stand up under strain.

In the past year, however, carbide-die development has been greatly accelerated, due largely to the efforts of the carbide manufacturers and precision die builders. The Allegheny Ludlum Steel Corporation, being a major producer of carbide, played an important part in this work. All types of dies were built, various tests were made, methods of manufacture were developed, and standard procedures were adopted.

To simplify the discussion of practices generally adopted in manufacturing carbide dies, the steps followed in building a simple drawing die will be described. The die is employed for the first operation in deep-drawing cold-rolled material 1/16 inch thick to an inside diameter of 4 inches.

It is general practice to construct carbide drawing dies with a draw ring of carbide mounted in a steel casing. In an effort to keep the cost of such dies at a minimum, the first thing to be considered is how to utilize the least amount of carbide. It is known by experience that when a part is to be drawn to an inside diameter of 4 inches, the die must have a wall thickness of 3/4 inch. In this case, the carbide ring was made 5 1/2 inches in diameter by 3/4 inch thick.

Since the carbide must be backed up and supported as rigidly as possible, caution must be used in selecting the encasing material. The outside diameter and thickness of the case should be as large as the machine and set-up in which it is to be used will permit. In this instance, a tool-steel forging with an outside diameter of 9 inches and a thickness of 4 inches was employed.

As the carbide must be supported as closely as possible, a shrink fit is necessary. The accompanying table shows the recommended shrinkage allowances for carbide inserts in tool steel. A shrink fit between carbide and tool steel is greatly helped by the differences in the coefficient of thermal expansion of the two materials, the coefficient of expansion of carbide being only one-half that of steel. The tool-steel casing need only be heated to approximately 700 degrees F. Since this is below the draw temperature of the steel, the hardness of the casing will not be affected.

The inside diameter of the carbide ring will be reduced, in this particular case, approximately 0.002 inch. By doing the shrinking before finishing the bore of the carbide ring, the operation of resizing the ring is eliminated.

Shrinkage Allowances for Carbide Inserts in Tool-Steel Casings

Outside Diameter of Carbide Insert, Inches	Shrinkage Allowance, Inch
0.437 to 0.562	0.0013 to 0.0018
0.562 to 0.687	0.0016 to 0.0021
0.687 to 0.812	0.0021 to 0.0026
0.812 to 0.937	0.0025 to 0.0030
0.937 to 1.125	0.0028 to 0.0033
1.125 to 1.375	0.0035 to 0.0045
1.375 to 1.750	0.0038 to 0.0048
1.750 to 2.000	0.0043 to 0.0053
2.000 to 3.000	0.0045 to 0.005
3.000 to 3.500	0.0055 to 0.006
3.500 to 4.000	0.0065 to 0.007
4.000 to 5.000	0.0070 to 0.008
5.000 to 6.000	0.0080 to 0.009
6.000 to 7.000	0.0090 to 0.010

Carbide Dies Having Irregular Contours Should be Diamond Bored

Diamond boring is recommended for carbide dies having one or more fillets or other contours that would be difficult to produce with a straight diamond grinding wheel. The dressing of diamond wheels to suit certain contours or angles is limited, however, and is costly with respect to the amount of labor required and the initial cost of the diamond wheel. Therefore, in the case of this draw ring, where the drawing radius is 5/16 inch, a diamond boring tool was employed to machine the fillet. A speed of about 100 to 120 surface feet per minute was used, with a depth of cut of 0.002 inch and a feed per revolution of 0.004 inch. From 0.001 to 0.002 inch of stock should be left on the fillet or in the bore of the part for lapping after the diamond boring operation.

Grinding of Carbide Dies

A 100-grit vitrified diamond wheel having 100 concentration should be used for rough-grinding of carbide dies, and a 180- to 220-grit wheel with the same concentration for finish-grinding. In mounting a new diamond wheel, extreme care should be taken to make certain that the wheel runs true. The wheel should be tested with a dial indicator on all surfaces, and once tightened on its mount, should never be removed. Such wheels can be dressed efficiently by using a silicon-carbide wheel. The silicon-carbide wheel is not power-driven, but is rotated only by means of the diamond wheel, which revolves against it.

In dressing a rounded contour on a diamond wheel, a common practice is to use a radius dresser which is mounted on a high-speed grinder equipped with a silicon-carbide wheel that revolves in a direction opposite to that of the diamond wheel. In surface-grinding carbide with a diamond wheel, common practice is to use a depth of cut of approximately 0.0002 inch and a cross feed of about 0.0005 inch. From 0.001 to 0.002 inch of stock should be left on the piece after grinding. This amount of stock is generally necessary to obtain a good surface finish in the subsequent lapping operation.

Good Surface Finish Lengthens Life of Carbide Dies

It is an established fact that carbide dies work best, and give the longest life, when they are lapped and polished to a good surface finish. This is a relatively easy task if proper methods and materials are employed. In polishing the round draw ring, best results were attained with a surface speed of 1400 to 1600 feet per minute. A brass pin, mounted in a hand grinder and coated with diamond powder suspended in olive oil, quickly removes grinding or boring marks from the surface of the carbide.

A wooden lap, mounted on a pin held in a hand grinder and coated with No. 5 diamond powder and olive oil, will produce a satin finish. This should be followed by an operation in which a felt polishing wheel is substituted for the wooden wheel. Medical cotton, wrapped around a piece of wood, will produce the same results. In lapping small holes, cotton twisted on a small wooden pin is usually satisfactory. A very small amount of No. 5 diamond paste is used in this operation. If an extremely high polish is desired, the same procedure should be repeated, substituting No. 6 diamond paste for No. 5 in the second lapping operation.

Welding Rod Position Can be Easily Checked when Making Girth Seams by Fastening a Spirit Level A to the Carriage of the Welding Machine

Positioning Carriage in Welding Operations with a Spirit Level

A small spirit level fastened to the carriage of a Unionmelt welding machine provides an easy method of checking the position of the welding rod when making girth seams. Accurate positioning of the rod is necessary to obtain proper welding conditions, since the fluid weld puddle must be kept as nearly horizontal as possible. For this reason, on inside girth seams, the rod is set ahead of the low point, so that the puddle will form at the bottom of the curvature and start to solidify while the surface is in a horizontal position.

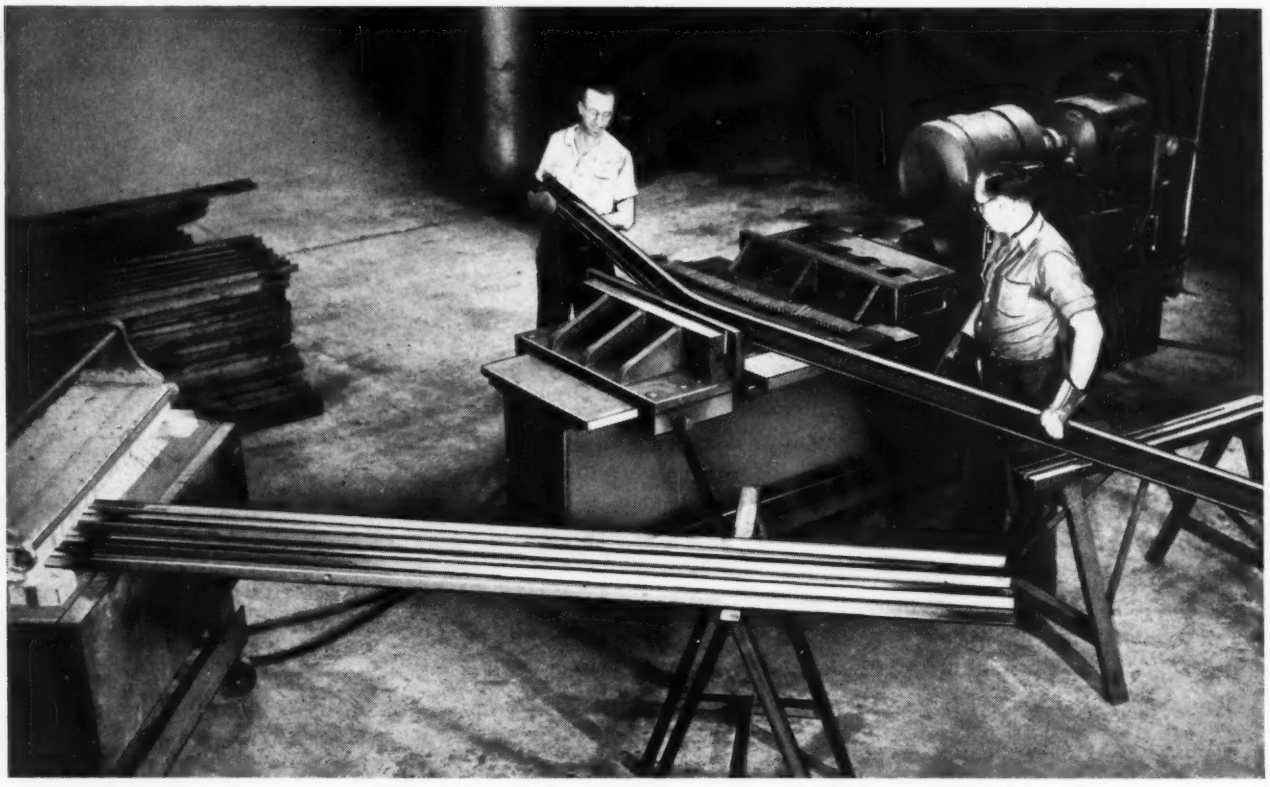
In a welding operation, the operator looks at level *A* and adjusts the speed of the carriage so that the bubble will remain centered. The carriage speed is thus matched with the rotation of the work, and the welding rod is kept at the proper lead distance. A rack and pinion *B*, placed on the carriage under the mounting head, makes it possible to position the welding head over the seam quickly and easily.

* * *

Increased Use of Production Machines in the Automotive Industry

Since 1941, the investment of the automotive industry in production machinery has more than doubled. Today, motor vehicle and parts plants in the United States have about 400,000 production machines, or nearly double the total in 1941. The industry employs almost a million persons, which is a third more than in 1941.

Bending Heavy Bars and Structural



IN the manufacture of harvesters and other farm equipment at the LaPorte Works of the Allis-Chalmers Mfg. Co., it is necessary to bend bars, tubes, angle-irons, channels, etc., of thick section to form various structural members. Hydraulically operated bulldozers are employed for this purpose because of their adaptability to the bending of different shapes having a wide range of cross-sections.

Tongue tubes for Allis-Chalmers side rakes are bent from rectangular welded rail-steel tubing in the set-up shown in Fig. 1. The welded tubes are 2 1/4 inches high by 1 3/8 inches wide, with a wall thickness of 0.154 inch and an overall length of 52 5/8 inches. Prior to bending, the tubes are heated to a temperature of 1450 degrees F. in the portable gas-fired furnace seen at the left. Although heating facilitates bending, it is not required for this purpose. In fact, many steel parts of low carbon content and simple shape are bent cold. Heating does, however, minimize spring-back of the part after bending. The decision as to whether to bend hot or cold depends upon the material and the complexity of the part, and can be based on judgment and experience only.

Bending of this part is accomplished at the rate of 60 per hour on a hydraulic bulldozer having a capacity of 50 tons. The heated tube is located against an end-stop on the side of the stationary die, as shown in Fig. 2. The stationary die is bolted to the foot or back-up angle of the machine, seen at the right, which can be moved to three different locations along the length of the machine.

With the tube in position, a movable die, bolted to the ram of the machine, is hydraulically advanced along the platen of the machine to bend the tube to the desired shape, as seen in Fig. 3. A mechanically adjustable positive stop is employed to limit the movement of the ram die, and prevent crushing of the tube. Cover plates project from the top of both the movable and the stationary dies to hold the work down during the bending operation. It is necessary to twist the tube to produce vertical faces on the finished part.

The ram stroke on the 50-ton bulldozer can be adjusted up to a maximum of 18 inches. Relief valves provide for varying the hydraulic pressure exerted on the part being bent, which is foot-treadle controlled. The stroke can be stopped and the ram returned at any point by releasing the foot-treadle. For rapid-traverse closing, the ram speed is 400 inches per minute; for pressing, 70 inches per minute; and for

Shapes on Hydraulic Bulldozers

Hydraulically Operated Bulldozers of 50 and 100 Tons Capacity are Employed at the LaPorte Works of the Allis-Chalmers Mfg. Co. to Bend Tubes, Channels, Bars, and Other Shapes as Thick as 1 Inch. Details of the Bending Techniques and Dies Used are Described in This Article

By CHARLES H. WICK

rapid-traverse return, 530 inches per minute. When worn, the platen can be remachined and shimmed to height.

Bulldozer dies are generally made from cast iron or mild steel. For sharp bends or for forming abrasive materials, tool-steel inserts are incorporated in the dies. In designing dies to be employed for cold bending, allowances must be made for spring-back of the part after forming. For hot bending, allowances must be made in the die design for shrinkage of the formed part. Bending to a radius equal to or less than the thickness or width of the material, depending upon the plane of bending, is difficult, and in most cases requires heating of the part. Parts are also generally heated when multiple bending is required.

In bending a part, the metal must be stressed beyond its yield point, so that it undergoes deformation or stretching. Since the ductility of the metal determines the amount it can be deformed before fracture, this property of the material to be formed must be considered in designing the die.

The amount of stretch that occurs in the outer part of the bend, assuming that the ductility of the metal is not exceeded, depends upon the radius of the bend and the thickness of the plate. For any thickness, the percentage of stretch per unit of length increases as the radius of the bend decreases. For any radius of bend, the percentage of stretch per unit of length increases as the thickness of the material increases.

Arch frames for the side rake are formed from 5.4-pound structural-steel channels, 4 inches wide by 156 inches long, at the rate of 20 per hour on a hydraulic bulldozer. The channels are heated to about 1500 degrees F. in a gas-fired furnace. A flexible mandrel, consisting of a series of cast-iron blocks strung on a wire

Fig. 1. Rectangular Tubing is Heated to 1450 Degrees F. before Bending in the Hydraulic Bulldozer Seen in the Background

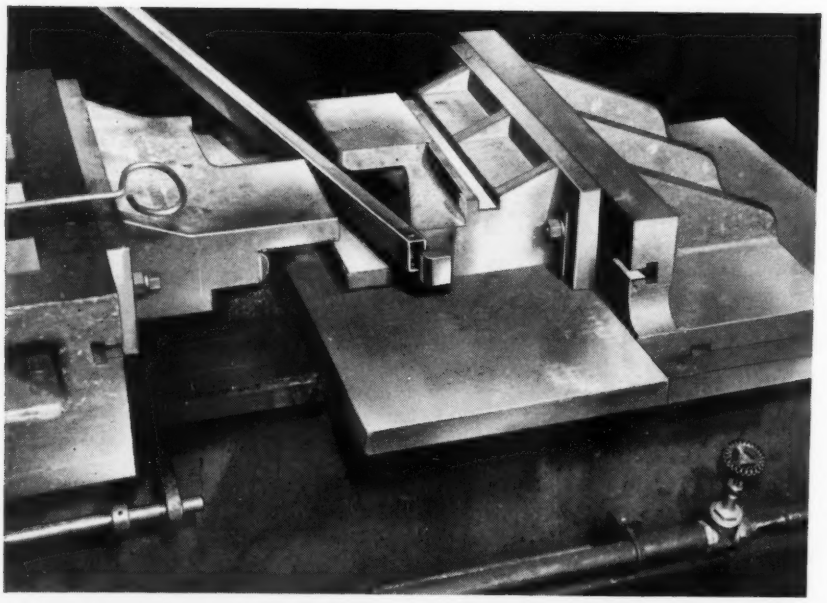


Fig. 2. Close-up View of the Dies Employed for the Bending Operation Illustrated in Fig. 1. The Tube is Located against an End-stop on the Stationary Die

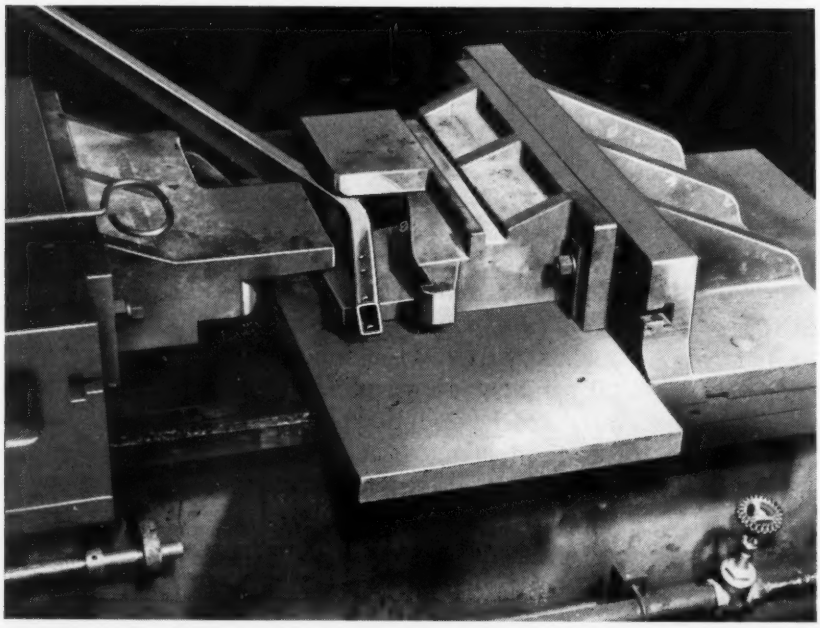


Fig. 3. Here the Rectangular Welded Tube has been Bent to Form a Side-rake Tongue. A Production of 60 per Hour is Obtained in This Operation

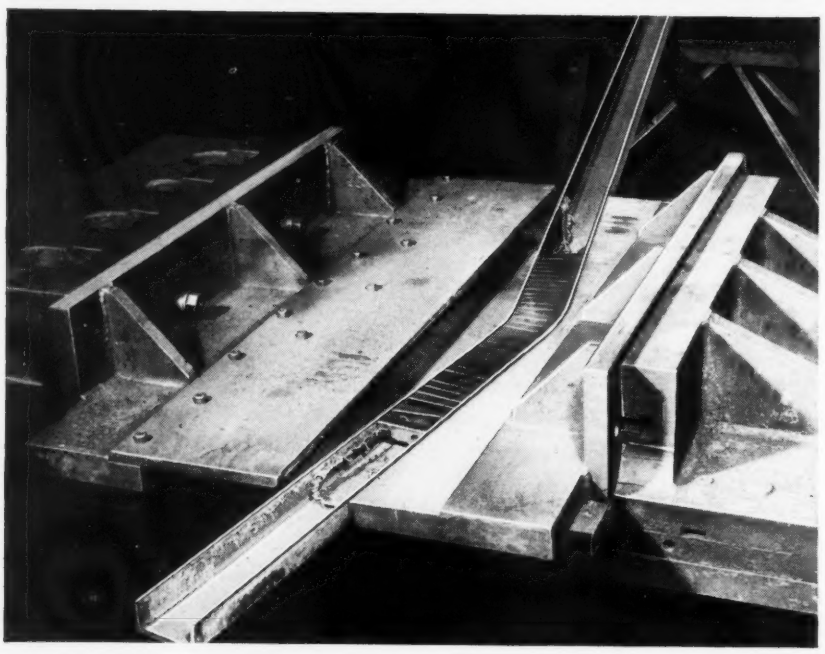


Fig. 4. A Flexible Mandrel Consisting of a Series of Cast-iron Blocks is Employed to Prevent the Legs of the Channel from Collapsing during Bending

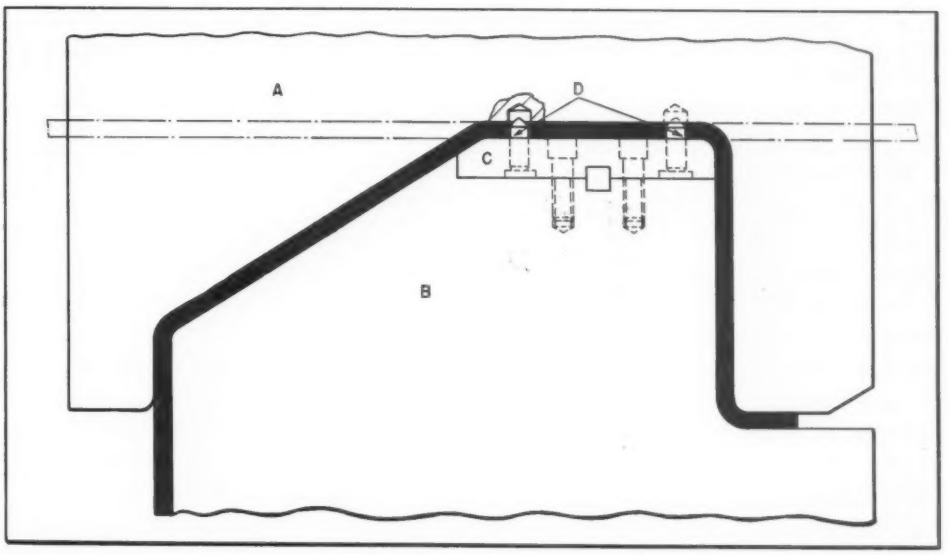


Fig. 5. Four Bends are Made in Steel Plates, 1/4 Inch Thick by 1 Inch Wide, with This Bulldozer Die Set

cable and spring-loaded from both ends, is placed in the channel, as seen in Fig. 4, to keep the legs of the channel from collapsing during the forming operation. In this case, the cover plate for retaining the part during forming is bolted to the ram die.

For complex bends on relatively short parts, it is sometimes possible to mount two or more die sets on one bulldozer and progressively move the part from station to station. The 50-ton bulldozers have a ram width of 36 inches, while the 100-ton machines have a ram 60 inches wide.

Also, relatively thin parts can sometimes be bent in multiple by stacking them vertically, one on top of the other. In one such case, eight hot-rolled steel plates, 3/16 inch thick, are bent simultaneously. It is impractical, of course, to stack the parts horizontally, since different radii would be formed on the various parts.

A bulldozer die set employed to produce one 60, one 30, and two 90-degree bends in hot-rolled S A E 1017 steel plates, 1/4 inch thick by 1 inch wide by 24 1/2 inches long, is shown in Fig. 5. This support bracket for a baling machine is cold-formed at the rate of 150 per hour. Reciprocating ram die *A* and stationary die *B* are made from machine steel. Die *B* is provided with a casehardened and ground in-

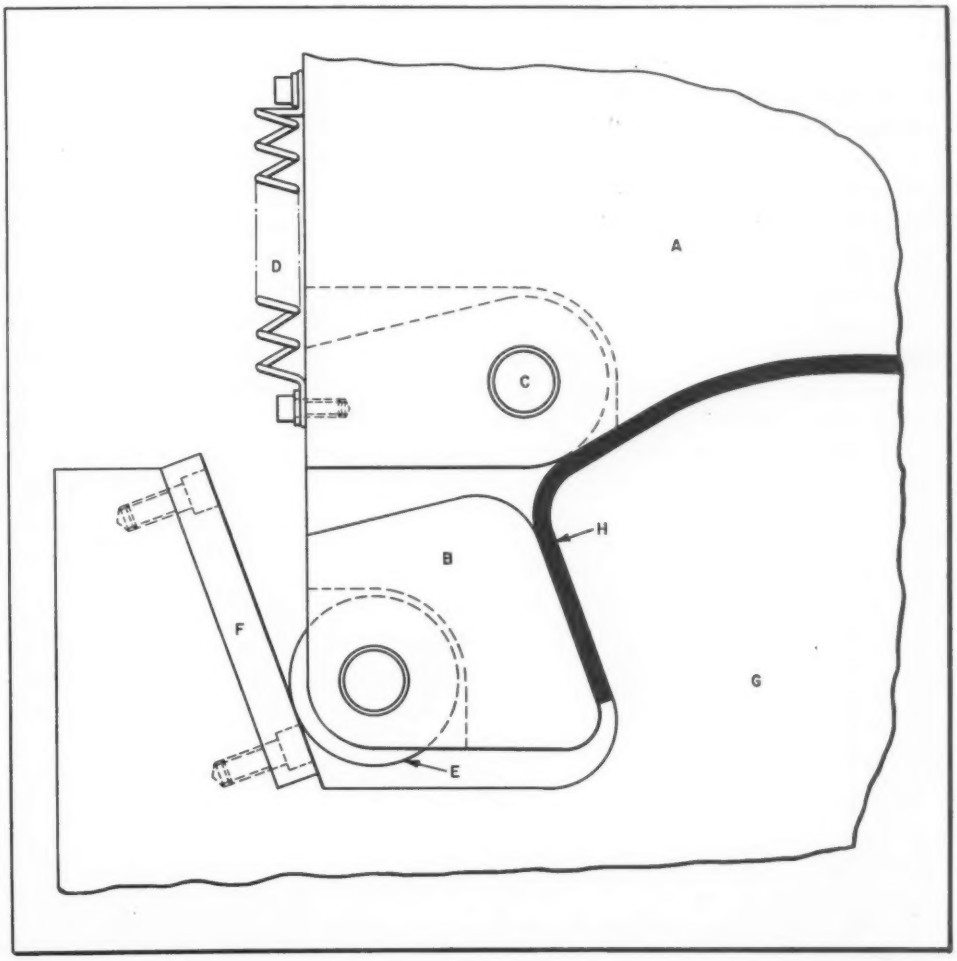


Fig. 6. Partial Plan View of a Cam-actuated Die Set Employed to Bend Part H to an Included Angle of Less than 90 Degrees

sert *C* to minimize wear and lengthen tool life. Hardened and ground pins *D* enter holes previously drilled in the work to accurately locate the part prior to forming.

One method of bending a part to an included angle of less than 90 degrees is shown in the partial plan view of a cam-actuated die set, Fig. 6. Ram die *A* is recessed to receive a tongue on bending block *B*. The bending block is free to pivot about pin *C*, and is normally held in against the recessed wall of die *A* by the action of spring *D*. As the ram die is advanced, roller *E*, which is pinned to the front end of the bending block, comes in contact with cam-plate *F* bolted to stationary die *G*. Continued movement of the ram die causes the bending block to swing to the right, forming part *H* as shown. Bending block *B* and roller *E* are casehardened after machining, and cam-plate *F* is casehardened and ground.

This die set is employed on a 100-ton hydraulic bulldozer to hot-form harvester pick-up shoes from hot-rolled S A E 1017 steel bars at the rate of 40 per hour. The bars are 1/4 inch thick by 3 1/2 inches wide by 33 7/16 inches long.

One of the most difficult shapes to form is structural angle-iron. When formed in the horizontal plane, with one leg of the angle flat on the platen of the bulldozer, the part tends to warp at the center of the bend. To overcome this tendency, a second-station die was used, which was tilted at an angle of 60 degrees to equalize the pressure on the legs of the angle.

A cross-sectional view of such a die set, used for hot-bending a 1- by 1- by 12 5/16-inch angle-iron to a radius of 8 1/8 inches, is seen in Fig. 7. Angle-iron *A* is located by pins *B* and *C*, which are pressed into die insert *D*. The insert is bolted to the angular face of stationary die *E*. The forming insert is bolted to ram die *G*.

Tallow Grease Used to Lubricate Aluminum-Cutting Tools

By LEO M. CAREY

Many different types of cutting fluids and lubricants are being used to improve the cutting action of drills, taps, saws, and other tools when machining aluminum. It was found, however, when tapping small holes in very soft aluminum, that the metal gouged the flutes of the tap when conventional fluids were employed. The tap broke quickly and rough threads were produced on the work.

These difficulties led to the trial of a non-abrasive buffing compound as a lubricant. A tallow grease stick was applied to the end of the tap to coat it for about 1/2 inch of its length. The results were ease of tapping, absence of gouging, and a fine finish on the threads produced. Also, with this type of lubricant, holes were tapped in approximately one-third the time formerly required. Equally successful results were obtained when tallow grease was used as a lubricant in drilling small holes.

Another satisfactory application of tallow grease was in cutting off thin-walled aluminum tubing, up to 5 inches diameter, with a circular saw. With previous lubricants, the saw formed a burr of such a size that it required a lengthy operation for its removal. By holding the grease stick against the teeth while the saw was rotating and before it was fed into the tube, a cut practically free from burrs was obtained.

It was also found that tallow grease stick facilitates the cutting action of other tools used on aluminum, and that production time on many operations is appreciably reduced.

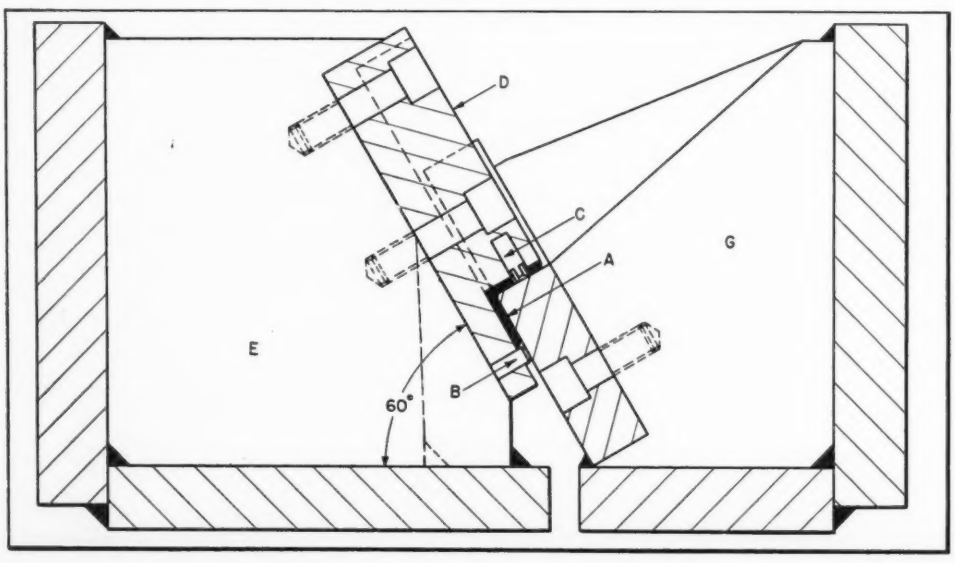


Fig 7. Angle-irons are Bent on the Bulldozer by Employing a Second-station Die Tilted to an Angle of 60 Degrees to Equalize the Pressure Exerted on the Part

How to Quench Tool and Die Steels

Tool and Die Steels Should be Quenched from the Austenitizing Temperature to Room Temperature in Such a Way as to Obtain Maximum Hardness — Second in a Series of Articles

By PETER PAYSON
Assistant Director of Research
Crucible Steel Co. of America

THERE are two temperature levels that are important during the cooling of tool and die steels from the austenitizing temperature. One of these is from about 1350 degrees F. to 900 degrees F., and the other is from approximately 700 degrees F. down to room temperature. If the time taken in cooling from 1350 degrees F. to 900 degrees F. is long, the steel generally will be soft when it has cooled to room temperature; if this period of time is short, the steel generally will be hardened. Some steels must be cooled through this temperature level in as short a time as possible in order to be hardened. Others will harden even if the cooling time is not so short.

The cooling time can be regulated by the choice of the quenching medium. If the tool is cooled in air, the rate of cooling is fairly slow. For faster cooling, the part can be quenched in liquid salt at a temperature between 1100 and 400 degrees F. and then cooled to room temperature in air; or, it can be cooled in oil all the way down to room temperature. The fastest cooling is obtained by quenching in circulating water or brine held at about 40 to 70 degrees F.

The time required for 1-, 2-, and 3-inch rounds to cool from 1350 to 900 degrees F. in air, in oil, and circulating water is given in the accompanying table. It will be seen that the time needed to cool the bar in air is much longer than to cool it in oil or water; that the oil quench takes a much longer time to cool the steel than the water quench; and that the center of the bar in the water quench takes a much longer time to cool than the outside.

When steel is cooling from 1350 to 900 degrees F., the austenite has a tendency to transform to soft mixtures of ferrite and carbide, and it will transform if allowed enough time. The time necessary for transformation depends on the composition of the steel; usually, the more complex the steel—the more it contains of the alloying elements manganese, molybdenum, chromium, and nickel—the longer the time required for transformation.

Carbon tool steel of the composition given in Table 1 of the article "Heat-Treatment of Tool and Die Steels" (see page 162, January, 1949, MACHINERY) and indicated in the upper right-hand corner of Fig. 2, transforms very rapidly at this temperature level; the oil-hardening tool steel (Fig. 1) less rapidly; and the complex high-carbon high-chromium steel (Fig. 3), the high-speed steel (Fig. 4), and the chromium hot-work steel (Fig. 5) require even more time. The important fact to remember is that if transformation does not take place in this temperature range, the steel will harden while it cools to room temperature, whereas if transformation does take place, the steel will be either soft or only partially hardened after it has become cooled.

Transformation of the austenite of any steel may take place over the entire range of temperature, from critical down to room temperature, but at some temperatures, the tendency to transform is much greater than at others. These tendencies are shown on charts called transformation-temperature-time curves, which are maps of the behavior of the austenite of the steel. Charts for the five typical tool steels listed in Table 1 of the first article in this series, referred to pre-

Time Required to Cool Round Bars from 1350 Degrees F. to 900 Degrees F.

Bar Size, Inches	Section of Bar	Cooling Medium		
		Air	Oil	Water
1	Surface		3 sec.	1 sec.
	Center	4 min.	10 sec.	4 sec.
2	Surface		10 sec.	1 1/2 sec.
	Center	10 min.	30 sec.	15 sec.
3	Surface		20 sec.	3 sec.
	Center	17 min.	60 sec.	35 sec.

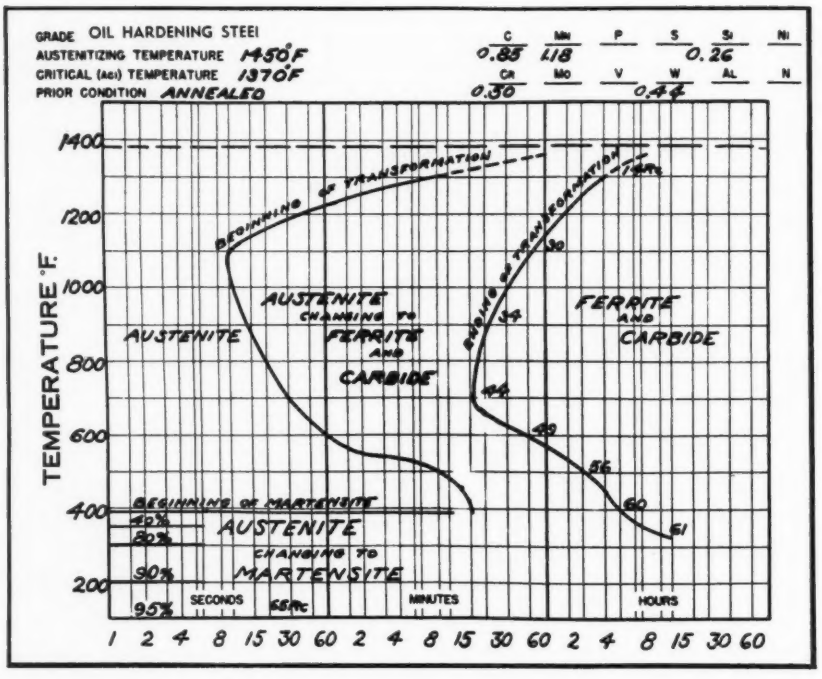


Fig. 1. Transformation Curves for a Typical Oil-hardening Steel of the Analysis Shown at Upper Right-hand Corner of Diagram

viously, are given in the present article. The chart for the oil-hardening tool steel is shown in Fig. 1. The curved line at the left in the diagram is marked "beginning of transformation." Austenite will remain untransformed at any temperature if the steel is held at that temperature for less than the time indicated by the line marked "beginning of transformation." For example, the austenite in this steel will remain untransformed at 1300 degrees F. for about five minutes, but if the steel is held at that temperature for a longer time, transformation will start. If the steel is held at 1100 degrees F. for more than ten seconds, transformation of the austenite will start; whereas if it is cooled quickly to 500 degrees F. and held at that temperature, transformation will not start for nearly ten minutes.

If the steel is cooled so that transformation of the austenite does not take place by the time the temperature drops to 400 degrees F., the hard martensitic structure will begin to form and will continue to form as the steel cools below 400 degrees F. This is a very important hardening operation in steel. While a certain period is required for austenite to transform to ferrite and carbide at high temperatures, the transformation to martensite does not depend on time, but takes place at once as the temperature drops below the line marked "beginning of martensite."

If only martensite forms in the steel by the time it cools to room temperature, the steel is fully hardened. But since the outside of a bar can cool more rapidly than the center, depending on the size of the bar and on the quenching medium employed, it is possible for a bar to be only partially hardened at the center while the outside is fully hardened. This is the case with carbon tool steel treated in fairly large sections.

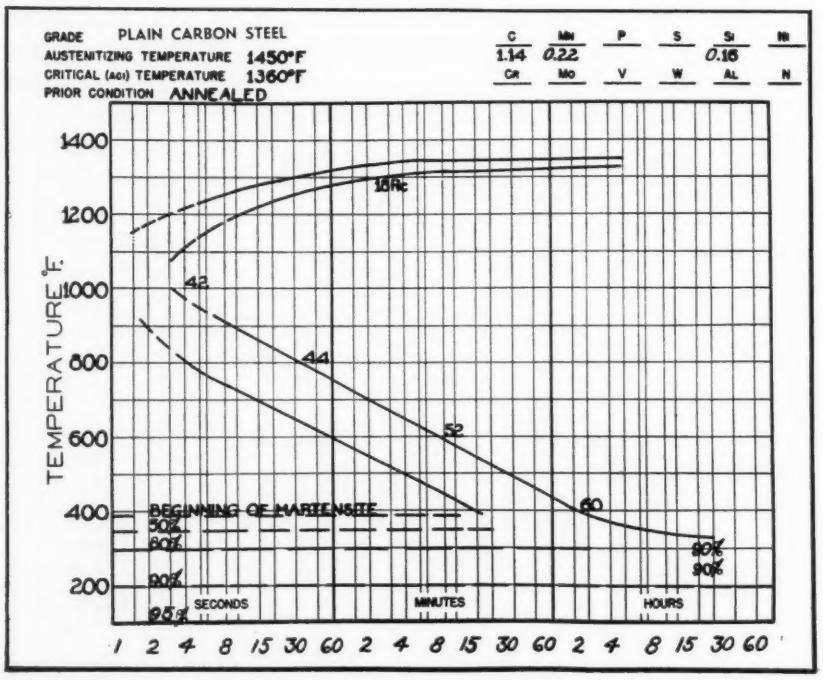


Fig. 2. Transformation Curves for a Plain Carbon Tool Steel

When austenite transforms to martensite during the cooling of a steel, a definite and permanent expansion takes place in the steel due to the fact that martensite is not as dense as austenite, or as the annealed structure of the steel. If this expansion is not permitted to take place freely, stresses may develop in the steel to such a degree as to cause the part to crack or distort. To keep cracking and distortion at a minimum, it is desirable to allow the martensite

to form slowly, so that the steel can gradually accommodate itself to the expansion stresses. This is the basis of the heat-treatment called "martempering," which consists of cooling the steel rapidly in hot salt, oil, or water to the martensite temperature and finish cooling in air down to room temperature.

Another modified form of hardening, introduced by Davenport and Bain about ten years ago, is called "austempering." This consists of quenching the steel in salt to a temperature below the region of rapid transformation but above the martensite temperature, and holding it at this temperature for a long enough time for the austenite to be completely transformed at this temperature. The transformation product formed in this manner is called "bainite." This product also is a hard structure, but not so hard as martensite. For example, in the oil-hardening steel referred to, martensite has a hardness of about 65 Rockwell C, whereas bainite has a hardness of about 45 to 60 Rockwell C, depending on the temperature at which the bainite is formed. This is indicated in the transformation diagram, Fig. 1, by the Rockwell hardness numbers along the curved line at the right of the chart, which represents the time required for transformation to be completed at any point below the critical temperature.

Complete transformation of the austenite to ferrite and carbide occurs when the time that the steel is held at any temperature is greater than that marked off by the line labelled "ending of transformation." For example, if the steel is cooled from 1450 to 1300 degrees F., and held at that temperature for four hours or longer, the austenite will be completely transformed to ferrite and carbide. If it is cooled to 700 degrees F. and maintained at that temperature, it will be completely transformed in about twenty minutes. Finally, if it is quenched to 400 degrees F. and held at that temperature, it will be completely transformed after about four hours.

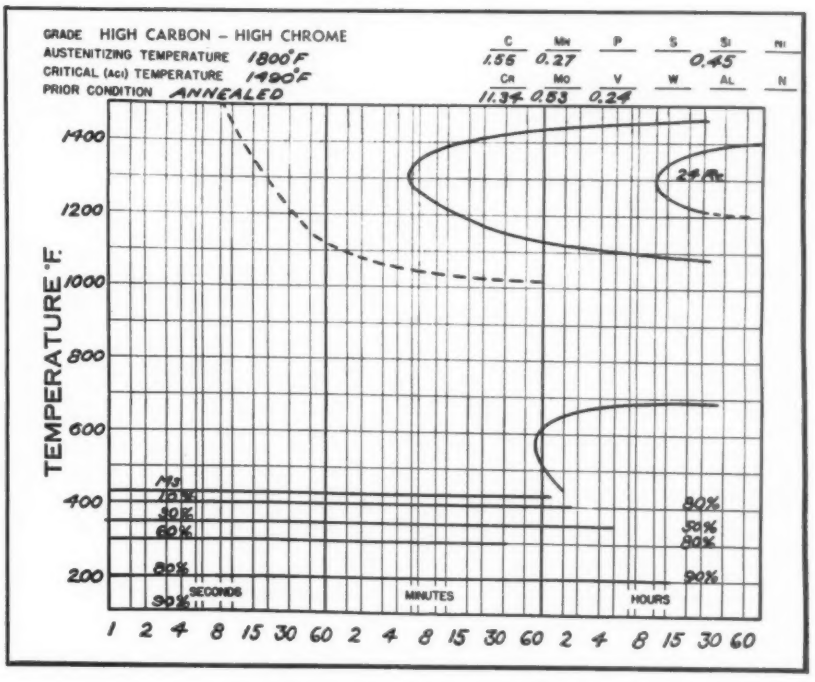


Fig. 3. Transformation Curves for a High-carbon High-chromium Steel. The Dotted Line at Left Indicates Carbide Precipitation

The section between the two curved lines on the chart shows a gradual transformation of austenite to ferrite and carbide. At 1100 degrees F., the transformation starts in about ten seconds, but it proceeds slowly and does not reach completion until the steel has been at this

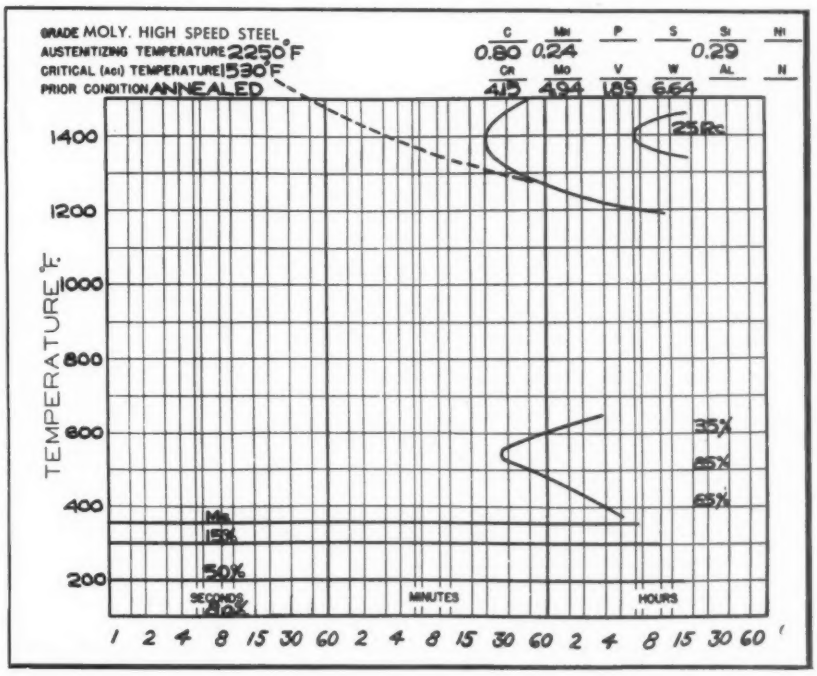


Fig. 4. Transformation Curves for Molybdenum High-speed Steel

temperature for about thirty minutes. If the steel is cooled in such a way that it is allowed to remain at 1100 degrees F. for not longer than one minute, only a portion of the austenite transforms. The remainder of the austenite would behave like the original austenite, and could be made to transform to martensite or bainite by selected cooling or holding procedures. Once the transformation of the austenite is complete, however, no further change can be produced in the steel by cooling. The ferrite and carbide are not affected by cooling rates, and since all the austenite has been used up, there is nothing in the steel to change during cooling.

The position of the end of the transformation line indicates how long the steel has to be held at temperature to complete the transformation. For example, it has been found that knock-out pins made from the steel represented by this chart give more satisfactory service when they are "austempered" than when they are hardened to form martensite. The pins are quenched in a bath at about 450 degrees F., held at that temperature for about four hours, and then cooled in air.

The numbers beside the line marked "ending of transformation" show the Rockell C hardness of the mixtures of ferrite and carbide formed at the temperature at which the number appears. For example, the transformation product formed at 1300 degrees F. has a hardness of 14 Rockwell C, while that formed at 700 degrees F. has a hardness of 44 Rockwell C. The lower the temperature at which the transformation takes place, the higher is the hardness. Martensite has a higher hardness than any of the other transformation products.

The reverse of this rule is the basis for softening, or annealing, steel; that is, the higher the transformation temperature, the softer is the steel. It happens also that the higher the transformation temperature, the longer it takes to complete the transformation, so that when a steel is to be annealed to get a soft product, sufficient time must be allowed for the austenite to transform completely at high temperatures before the steel is cooled to room temperature.

Steels of various compositions behave quite differently when they are cooled from an austenitizing temperature, just as they do when they are heated. Fig. 2 shows the transformation curves for the carbon tool steel. The time required to complete the transformation of austenite in this steel at about 1000 degrees F. is a matter of seconds.

If martensite is to be formed in this steel, it must be cooled very rapidly to a temperature below about 800 degrees F. A circulating water or brine quench is commonly used, and even then, martensite is formed only at the outside of the part. If service conditions require the center of a large part to be hard, this shallow hardening steel should not be used. Also, if a sizable section of this steel is to be hardened, it must be quenched in water or brine; therefore there will be drastic temperature gradients from the outside to the center of the piece and it will be subject to distortion and cracking.

Finally, if a steel having these transformation characteristics is to be "martempered" or "austempered," thin sections must be used, so that they can be cooled rapidly to about 450 degrees F. If the sections are small enough, this steel can be hardened in oil or even in air.

The transformation curves of the high-carbon, high-chromium steel are shown in Fig. 3. A new line is seen in this chart—the broken line at the upper left—which designates the time required for excess carbides to precipitate from the austenite. In many other steels of high-alloy, high-carbon content, the tendency for carbides to precipitate is appreciable, and this has considerable significance in the heat-treatment of the steel.

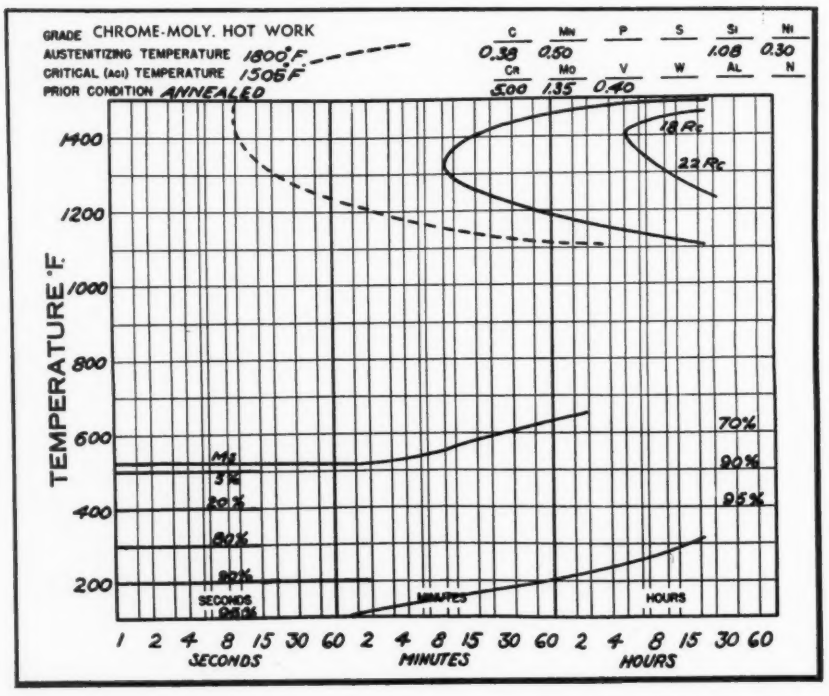


Fig. 5. Transformation Curves for Chromium-molybdenum Hot-work Steel

This line, which is known as the carbide line, indicates that carbides will precipitate quite rapidly at approximately 1600 to 1700 degrees F. The precipitation invariably occurs first at grain boundaries. Although it is not known directly what the effect of this grain boundary precipitation is, it is reasonable to expect that this condition decreases the toughness of the steel. It is known that such a condition lowers the cutting efficiency of high-speed steel.

This condition can be avoided by controlling the cooling of the steel through the temperature range in which the precipitation occurs. Obviously, the precipitation will not occur unless sufficient time is allowed at these temperatures. The cooling is usually sufficiently rapid in fairly large sections if they are quenched in oil, or in salt baths at about 1100 degrees F. or lower. Once the steel has been cooled below the carbide precipitation level, it may be cooled at the rate most suitable to the steel part being treated.

In the case of the high-carbon, high-chromium steel and the molybdenum high-speed steel (the transformation curves for which are shown in Fig. 4), treatment of the steel may be finished by an air cool, as the reactions at the lower temperatures are slow and the only change that can occur during the final cooling to room temperature is the desired formation of martensite. During the cooling below the Ms temperature, martensite forms in these air-hardening steels, as in the steels mentioned earlier. Because the cooling is relatively slow in air, the steel can accommodate itself to the expansion that takes place when martensite forms, and therefore hardens with a minimum of distortion.

The transformation to martensite progresses only as the temperature of the steel drops. If the cooling is not allowed to continue to room temperature, or close to room temperature, before tempering, the desired hard structure, martensite, will not form, and the austenite will remain in the steel, which may cause trouble at a later time in the life of the tool.

Even when the high-speed steel and the high-carbon, high-chromium steel are cooled to room temperature, all the austenite does not transform. This is also true of the plain carbon, oil-hardening, and hot-work steels, but the amount of austenite retained is about 5 to 10 per cent, whereas up to approximately 20 per cent is retained in the high-speed steel as ordinarily treated. The amount in the high-carbon, high-chromium steel may vary from 10 to 20 per cent when the steel is austenitized at 1800 degrees F. to as much as 100 per cent if the steel is quenched from about 2100 degrees F.

As there is no advantage in retaining austenite in these steels, the heat-treated steel should be permitted to cool to at least 100 to 125 degrees F. before it is tempered. It is true that some parts have cracked because they were not tempered soon enough after they were hardened, but it is equally true that many tools have been spoiled because they were transferred to the tempering furnace too soon.

The transformation curves of the chromium-molybdenum, hot-work steel, Fig. 5, show the same sluggish high-temperature reactions as were indicated in the case of the high-carbon, high-chromium steel and the high-speed steel, but the lower temperature transformation to bainite, from about 600 degrees F. down, is more rapid. Even here, however, a long time is required for the transformation to be completed above 300 degrees F. Nevertheless, in the ordinary heat-treatment of fairly large sections of this steel by an air cool or by an interrupted quench, the final product is a mixture of bainite and martensite rather than all martensite. Work recently carried out indicates that there is not much difference in the properties of the hot-work steel heat-treated completely to martensite and that heat-treated to a mixture of martensite and bainite.

* * *

Colorimetric Determination of Aluminum in Zinc-Base Alloys

The analytical laboratory of Silverstein & Pinsof, Inc., 1720 N. Elston Ave., Chicago 22, Ill., announces that it is making its research papers available without charge to metallurgists, foundrymen, die-casters, and others interested in analytical problems and procedures. One of this series discusses "Colorimetric Determination of Aluminum in Zinc-Base Alloys." Detailed information is given on tests, solutions, set-up, and procedure.

* * *

Division of Engineering Mechanics Established at Stanford University

Stanford University, Stanford, Calif., has announced the establishment of a Division of Engineering Mechanics in the School of Engineering. The term "engineering mechanics" is considered synonymous with "applied mechanics." The course will cover the strength, endurance, vibration, and susceptibility to buckling of engineering structures and mechanisms.

Engineering News

New Gas-Turbine-Electric Locomotive Develops 4500 Horsepower

The first gas-turbine-electric locomotive to be built and operated in the United States, which is shown in the accompanying illustration, is a joint undertaking of the American Locomotive Co. and the General Electric Co. This locomotive will be placed in operation on a demonstration basis by the Union Pacific Railroad next spring after preliminary tests in the East.

The new locomotive is of single cab construction with an operating station at each end. It develops 4500 H.P., weighs 500,000 pounds, and has a continuous tractive effort of 68,400 pounds at 20.4 miles per hour. Geared to run at 79 miles per hour, the locomotive carries enough fuel for twelve hours' operation at maximum power.

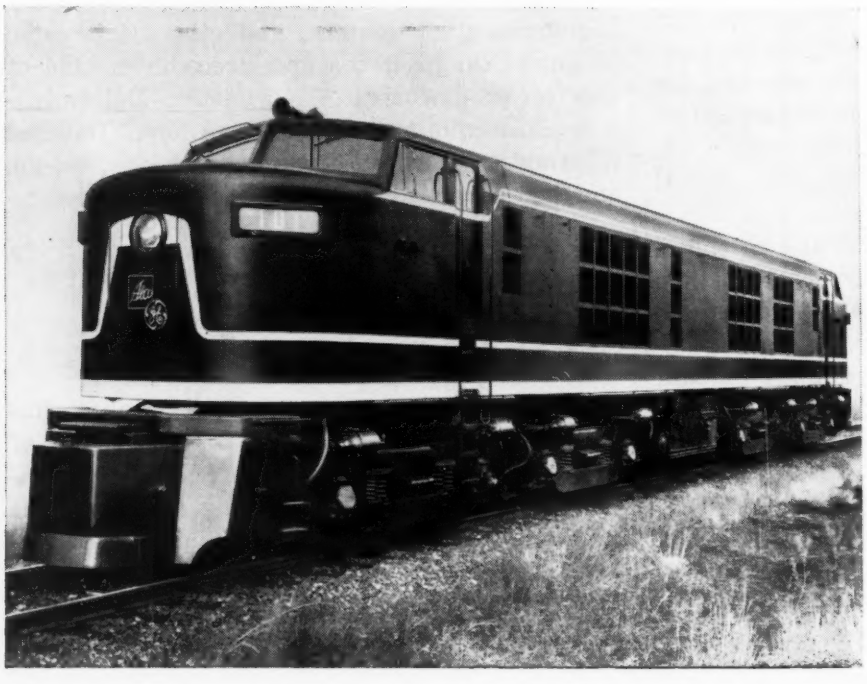
The compressor, combustion chambers, and turbine are of "in-line" construction. Air is drawn through the compressor into several combustion chambers and fuel is injected, the burning of the mixture causing the temperature of the compressed air to be raised. The resulting gases expand and move at great velocity against the turbine blades, rotating the shaft, which, in turn, drives the power plant compressor and the generator. Power from the generator is supplied to eight traction motors, each of which drives one of the eight axles of the locomotive.

Reversing Propellers of Multi-Engined Aircraft in Flight

Curtiss-Wright Corporation recently demonstrated to military, airlines, and government officials how reversible propellers can enable multi-engine aircraft to descend safely during emergency or procedure "letdowns" at more than double the aircraft's normal rate of descent without increasing the forward speed of the plane or imposing an extraordinary stress upon its structure.

The maximum rate of descent in multi-engine transport or military aircraft ordinarily ranges from 3000 to 4000 feet per minute. In tests, by reversing the propellers in flight, rates of descent have averaged 8000 feet per minute, and a rate in excess of 10,000 feet per minute has been attained—both rates having been achieved at forward speeds of less than 200 miles per hour. This will provide military aircraft with a safe and effective evasive technique by permitting extraordinarily fast changes of altitude, which would be extremely valuable in escaping flak areas or attacking aircraft.

The demonstration further indicated that this development will improve aircraft operating efficiency by permitting high-altitude aircraft to fly for virtually their entire course at their most efficient altitude. At present, much of the eco-



First Gas-turbine-Electric Locomotive to be Built in the United States Develops 4500 Horsepower

nomic operating advantage of these aircraft is reduced because of the fact that they must begin descending when they are only half way to their destination.

New Method of Measuring Piston Temperatures in Engines

An improved method of measuring heat in pistons of engines operating as fast as 2000 R.P.M. has been developed by engineers at the Beacon, N. Y., laboratories of the Texas Co. Previous mechanical devices for determining piston temperatures have often failed when subjected to high speeds, heat, and the reciprocating action of the pistons. Also, the formation of oil films may result in open electrical circuits. The new technique employs air-cushioned plungers which, at intervals, come in contact with a thermo-couple placed inside the piston. The heat is determined by measuring, on a meter, the current induced by the thermo-couple. Thorough elimination of oil films is achieved.

With the new arrangement, the terminals of the thermo-couple are mounted on a holder that extends below the piston skirt. The plungers are installed in the crankcase. A push-button valve induces air pressure behind the plungers, forcing them out into contact with the terminals. Contact is made at the lower portion of the piston stroke. After readings are taken, the valve returns to its normal position, inducing a vacuum behind the plungers. A wiping contact takes place, which eliminates the formation of oil films on the contact points. Contact is held long enough so that the meters need not be extremely sensitive.

Use of Oxygen in Producing Steels in Electric Furnaces

According to a recent report by the United States Steel Corporation, better stainless, alloy, and rimmed steels have been made in electric furnaces during the last decade through the use of oxygen for carbon reduction. With the increasing demand for stainless steels and the attempts to obtain production in large furnaces using stainless steel scrap, the use of oxygen plays an important role. The disadvantages of the use of ore for deoxidation prompted operators to turn to large-scale experimentation with oxygen for carbon reduction.

Among the advantages gained by using oxygen in the manufacture of stainless steels are the following: A high percentage of stainless steel scrap can be used; a high percentage of chromium from scrap is obtained; the oxygen-chromium reaction is exothermic, thus providing additional heat which lowers the power consumption per ton; the control of chromium content is better; and the control of quality is better, particularly in the case of the straight chromium grade of steel.

The major portion of the electric furnace steels produced probably embraces the alloy steels used for gears, bearings, and aircraft and automotive parts, in which quality, with respect to soundness and cleanliness, is very important. The reduction of carbon with oxygen seems to be the most reliable method of producing quality steel. The amount of hydrogen introduced is reduced to a minimum, and the purging of the oxygen further reduces the amount of hydrogen present in the bath.

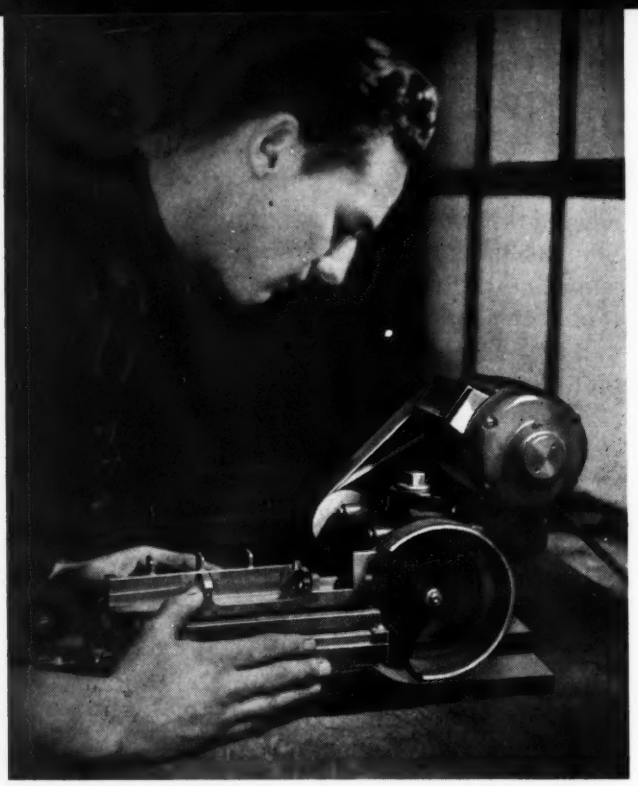
The advantages of using oxygen in the manufacture of quality alloy electric furnace steels include fast carbon reduction, with resulting fast heats; more positive control of oxidation and rate of carbon reduction; greater control of quality of heats; and greater recovery of manganese and chromium.

Since the war there has been greater electric furnace capacity than required for the production of quality alloy and stainless steels, while open-hearth capacity has been insufficient to meet the demand for rimmed steel. In an effort to relieve this condition, considerable tonnage of rimmed steel has been made in electric furnaces.

200-Inch Telescope Equipped with 5600 Bearings

The giant Mount Palomar telescope is equipped with a total of 5600 ball and roller bearings, so that virtually every moving part is mounted in anti-friction bearings. This extensive application of ball and roller bearings is claimed to make this telescope the most frictionless mechanism ever constructed. The 500-ton weight of the instrument can be directed toward any point in the sky by a fractional-horsepower motor that is not much larger than a tennis ball.

The 200-inch mirror of the telescope weighs 20 tons. It will increase the known limits of the universe twenty times, and will collect on its honeycombed surface light that started on its earthward journey from a star a billion years ago. The human eye is able to discern the light of a candle at night sixteen miles away. The Mount Palomar mirror can pick up the same light 41,000 miles away and transfer the image to a photographic plate.



Use and Care of Toolpost Grinders

Application of Toolpost Grinders; Selection of Grinding Wheels; and Methods of Adjusting Grinding-Wheel Cutting Action — First of Three Articles

By J. F. FISCHER
Manager, Sales Engineering
Simonds Abrasive Co., Philadelphia, Pa.

PORTABLE grinding machines used with machine tools are usually referred to as toolpost or lathe grinders. Some of these grinders are employed on the toolposts of lathes, while others are attached to machines by means of angle-plates or built integral with the machine. They are used not only on the compound rests of lathes, but on the clapper-boxes of shapers, on the rams of horizontal and vertical boring machines, on milling machines, with a vise or special fixture for bench work, as shown in the heading illustration, and even on other grinding machines to do special jobs. A toolpost grinder mounted on the tool-slide of a planer is illustrated in Fig. 1.

Toolpost grinders are used in straight production, in tool-rooms, and in maintenance work. Working easily to limits of ten-thousandths of an inch, these machines can often be applied to lathes or other standard machine tools without going to the expense of installing grinding machines.

Their accuracy and versatility make them useful in tool-rooms and die-shops. They may be used to convert a regular grinder into an internal grinder; a planer, shaper, or milling machine into a surface grinder; a milling machine or lathe into a cylindrical grinder; or a boring mill into any kind of grinder.

Maintenance work in industrial plants is similar in many ways to tool-room work. Runs are likely to be short, and yet require great accuracy. Toolpost grinders used in conjunction with a few basic machine tools do much to reduce plant maintenance costs.

The type of work to be done is an important consideration in selecting toolpost grinders. If the work is heavy external grinding, the machine should be powered with an induction motor whose speed is not affected by changes in the load. For light internal work, the high speeds given by universal motors are advantageous.

The size of machine on which the grinder is to be used must also be

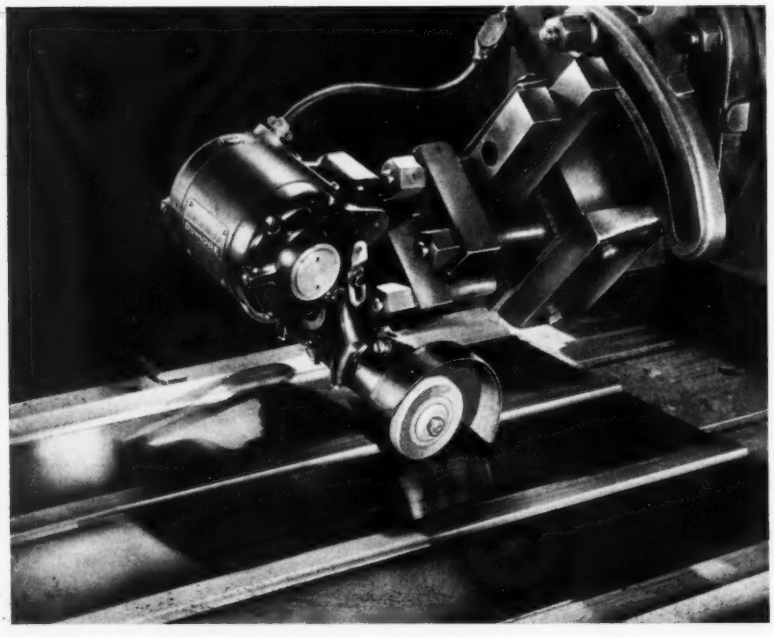


Fig. 1. Surface Grinding of Large Work is Facilitated by Mounting a Toolpost Grinder on the Tool-slide of a Planer

considered, because a large grinder mounted on a small machine tool is likely to cause vibration. Much bad grinding is due to vibration of the wheel.

Some makes of grinders are made to operate only in a horizontal position, and in order to operate vertically, special quills are needed to permit oiling the upper bearing. They can then be used in either position.

Care should be taken in selecting the quill to use. In external grinding one quill is employed for each machine. In internal grinding many may be used, because the size and depth of the hole in the work determine the quill to be employed. If the hole diameter is large enough, use a three-bearing quill to prevent vibration and consequent chatter marks. If this is not possible, use the shortest extension or spindle that will grind the hole.

Frequently, an unnecessarily long extension is selected with the purpose of increasing the scope of the quill. However, the longer the extension, the greater the vibration that can be expected. For instance, it is a mistake to try to grind a 3-inch hole with a quill having a 5-inch extension. In grinding deep holes, of 5 or 6 inches depth, without a three-bearing quill, it is best to use a lower speed than is indicated on the nameplate of the machine. Not over 23,700 R.P.M. should be used with wheels of 1/2 inch diameter or less, nor more than 14,600 R.P.M. for wheels from 1/2 inch to 1 inch diameter.

Selecting the correct wheel for the job is of great importance. In general, the same rules apply as in selecting wheels for regular grinding machines. A common rule in internal grinding is to limit the wheel diameter to about two-thirds the diameter of the hole, for maximum efficiency of wheel contact. The larger the wheel in proportion to the hole, the greater the area of contact between wheel and work, and the harder the wheel will act. This effect is more noticeable in the larger wheels. Therefore, a 7/16-inch wheel should be used to grind a 1/2-

Wheels Recommended for Use with Toolpost Grinders

Materials and Operations	Wheels to Use		
	Abrasive	Bond	Grain Size, Bond Grade, and Structure
Aluminum			
Cylindrical Grinding	Silicon-Carbide	Vitrified	38K8
Internal Grinding	Silicon-Carbide	Vitrified	46I9
Brass			
Cylindrical Grinding	Silicon-Carbide	Vitrified	36K8
Internal Grinding	Silicon-Carbide	Vitrified	46K8
Bronze (Soft)	(Use same wheels as for brass)		
Bronze (Hard)			
Cylindrical Grinding	Aluminum-Oxide	Vitrified	46M5
Internal Grinding	Aluminum-Oxide	Vitrified	60L5
Cast Iron			
Cylindrical Grinding	Silicon-Carbide	Vitrified	36K8
Internal Grinding	Silicon-Carbide	Vitrified	46K8
Cemented-Carbide Tools			
Off-hand Roughing	Green Silicon-Carbide	Vitrified	60I9
Off-hand Semi-finishing	Green Silicon-Carbide	Vitrified	80I9
Off-hand Finishing	Green Silicon-Carbide	Vitrified	120I9
Rubber (Hard)			
Cylindrical Grinding	Silicon-Carbide	Resinoid	30J7
Rubber (Soft)			
Cylindrical Grinding	Silicon-Carbide	Resinoid	30J7
Steel, High-Speed			
Cylindrical Grinding	Aluminum-Oxide	Vitrified	46K5
Internal Grinding	Aluminum-Oxide	Vitrified	46J5
Steel (Hard)			
Cylindrical Grinding	Aluminum-Oxide	Vitrified	46M5
Internal Grinding	Aluminum-Oxide	Vitrified	60J5
Steel (Soft)			
Cylindrical Grinding	Aluminum-Oxide	Vitrified	46N5
Internal Grinding	Aluminum-Oxide	Vitrified	46M5

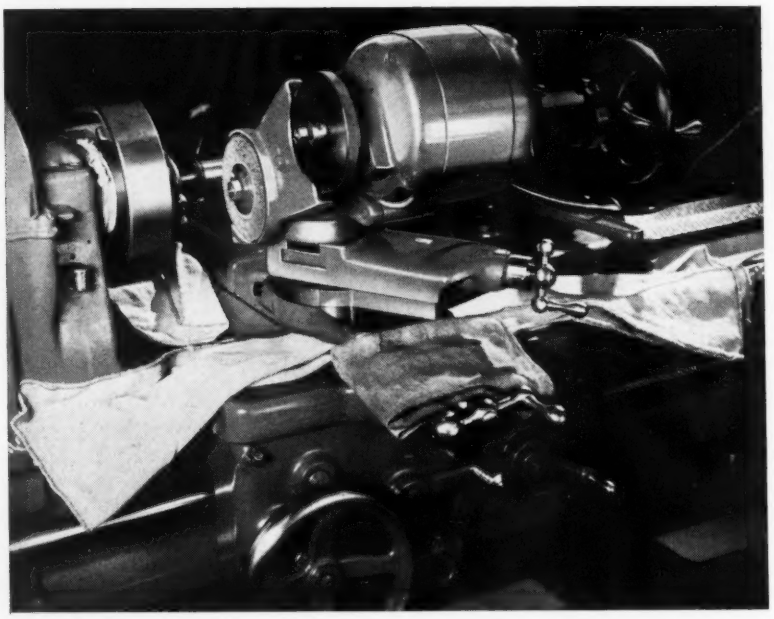


Fig. 2. When Toolpost Grinders are Used on Machine Tools, the Spindles and Ways Should be Covered for Dust Protection

inch diameter hole, a 1 3/4-inch wheel for a 2-inch diameter hole, and about a 10- or 12-inch diameter wheel for a hole 24 inches in diameter.

With some very large machines—about 10 horsepower—wheels as large as 20 inches in diameter are used for external grinding. These are used for rolls and large journals. In the majority of cases, toolpost grinders are employed for much smaller jobs—4- to 6-inch diameter wheels being the rule.

In selecting wheels, the material to be ground and the type of operation govern the choice. The wheels suggested in the accompanying table for different types of work are not hard and fast recommendations, but are merely intended to indicate what may be needed.

The basic abrasives used are aluminum oxide and silicon carbide. Ordinary aluminum oxide is tough and of high tensile strength. It is the most commonly used of all artificial abrasives. A specially refined aluminum oxide which is more friable than the regular type is adapted for precision operations on high-speed steel, special alloys, and similar operations where cool, fast cutting action is needed. It is generally used in wheels for tool and cutter grinding, surfacing, and similar work. Other aluminum-oxide abrasives are processed to give them a toughness and brittleness midway between those of the regular and the specially refined aluminum oxides. Such abrasives are used chiefly for saws and knives, as well as for some surfacing operations.

Regular silicon carbide is very hard and sharp. For this reason, it is used for grinding materials that are low in tensile strength, such as cast iron or annealed malleable iron, brass, bronze, aluminum, or stone. A special type of silicon-carbide abrasive is employed for grinding cemented carbides.

If the wheel is either too hard or too soft in grade of bond, its speed can be manipulated to vary the action a little. The way a wheel acts as to bond hardness depends upon the ratio of wheel speed to work speed. If it acts too soft, that is, if the wheel bond wears out before the abrasive grains wear, try increasing the wheel speed a little. Better still, reduce the work speed, for that will prevent the possibility of putting the wheel in the danger zone and will permit the removal of the same amount of material in a smaller number of cuts per minute. The "soft acting" condition of the wheel is due to the fact that the grains cut deeper when low wheel-to-work speed ratios exist than they do when relatively higher wheel-to-work speed ratios are used. If the wheel acts too hard, reduce the wheel-to-work speed ratio by decreasing the wheel speed. This results in increasing the depth of grain cut, because more material is removed in the same number of cuts per minute.

The correct wheel for a job will be "self-sharpening." That is, the abrasive particles will be held by the bond only while they are sharp and are cutting the material. If the wheel is too hard, the abrasive particles will remain in the bond after they become dull, causing the wheel to glaze and possibly burn the work. If the wheel is too soft, the particles will break or be pulled from the bond before they have done all the cutting work of which they are capable. Hence, as we have just seen, the first thing to do with a wheel which acts too hard or too soft is to change the wheel-to-work speed ratio by one means or another.

If the wheel condition is not affected by altering the wheel-to-work speed ratio, try the in-feed and traverse. The following suggestions apply to cylindrical, surface, or internal grinding. It is to be remembered, in making changes, that it is assumed that other conditions will remain constant.

It is possible to increase the compression load on a wheel and so make it act softer by increasing the in-feed; however, the power and rigidity of the machine must be considered. Conversely, reducing the in-feed will have the opposite effect.

Fig. 3. Accurate Die Grinding is Accomplished on a Rotary Table with Toolpost Grinder Mounted on Vertical Milling Machine

If neither of these manipulations affects the apparent hardness of the wheel, try the speed of traverse. In cylindrical and flat surface grinding, the traverse speed is the width the wheel moves per revolution of the work, or movement of the work with reference to the wheel. A traverse greater than the width of the wheel will not grind the entire surface. Increasing the traverse makes the wheel act softer, and decreasing it makes the wheel act harder. Altering the traverse rate effectively modifies the wheel action in internal grinding.

So far we have discussed only the adjustment of speeds and feeds to change the cutting action of a wheel. However, it is possible to change the cutting action by dressing—to which much attention should be given. A skilled operator often boasts that he can dress a coarse wheel for fine finish-grinding. That is undoubtedly true, but it is better to select a wheel of the right grit first.

To make a fine wheel give a coarse effect, try traversing the diamond dressing tool across the wheel face rapidly. The result is to coarsen the surface of the wheel, which gives rapid material removal.

For finish-grinding with a wheel that is too coarse, try dressing with a light in-feed. The relatively smooth wheel face will remove material slowly, but will give a very smooth surface finish. It is also possible to improve the finish by lowering the work speed on the finish cut. Each grain cuts for a much smaller time, and so does not leave long marks.

In selecting a wheel, it is well to pay careful attention to the structure of the wheel—that is, the relative arrangement of abrasive and bond in the wheel. The structure is indicated by the number following the grade letter; the higher the number, the more open the spacing between grains in the wheel. Open-structure wheels are used for grinding soft ductile materials, to permit the widely spaced grains to get the needed penetration, and to allow room for the consequently larger chips. They are also used where pressure is likely to vary, as with off-hand grinding. It is desirable when grinding very hard material to have as many grains as possible working, which is accomplished by using wheels of close structure. Such wheels are for fine finishes or in cases where formed wheels are required that must retain their shape.

Great care should be taken to keep machine tools free from abrasive dust. This may come from the use of the toolpost grinder itself or from other grinding, buffing, or polishing wheels adjacent to the machines. In using a toolpost grinder on another machine tool, the ways of the machine should be protected by covering them with canvas or oilcloth, as illustrated in Fig. 2. The spindle bearing should be protected by wrapping a piece of cloth around the spindle. The grinding wheel dust can be caught by placing a receptacle of oil or water directly below the grinding wheel to catch the particles of dust. If the dust from surrounding machines is very bad, or if much grinding is done on fiber, plastic, or rubber, it is advisable to install a dust collection system. While toolpost grinders are designed to provide protection against the abrasive dust they cause, the machine tools to which they are attached are not, as a rule. After using the machines for grinding, they should be carefully cleaned.

In mounting a toolpost grinder on a shaper, it must be positioned so that all grinding grit is thrown off the ways of the ram. In mounting on a milling machine, the toolpost grinder is usually attached to the outer arbor support. To give circular motion, a rotary table may be fastened to the work-table of the machine, as shown in Fig. 3. If internal grinding is to be done on a vertical boring mill, the hole may be large enough to accommodate the entire grinder, using an external type of quill. If not, an extension may be used.

Progressive Piercing, Punching, and

Multiple Progressive Dies — Dies for Producing Parts of Intricate Shape — Coil-Feed Drawing and Blanking Dies — Second of Two Articles

By CHARLES R. CORY

IN the first installment of this article, published in January MACHINERY, page 152, two-stage progressive dies designed for manual feed and three-stage progressive dies for either automatic or manual feed were described. The present article describes multiple dies for high-production requirements, die designs for producing complex-shaped parts, dies embodying cam action in their design, and coil-feed drawing and blanking dies.

Multiple Progressive Dies

If production requirements are high and presses of suitable capacity are available, it may be desirable to produce parts in a multiple progressive die. An angular-shaped part such as those produced in the die sets described in the previous article can be made two at a time in a die of the type illustrated in Fig. 1. In the first stage of this unit, a hole is pierced in the strip by punch *A*. During the first and second stages, a notching punch cuts away the scrap areas *B* and *C*. The long tongue-like part of the notch frees the stock so that it can be flanged. In the second stage, the pilot-pin *D* enters the pierced hole. The clearance hole for this locating pin continues through the die-shoe to allow dirt, oil, and shavings to fall through. A spring pin *E* strips the stock off the straight portion of the pilot-pin.

In the third stage, the flanges *F* and *G* are formed by blocks *H* and *J* as the stock is held from shifting by the upper pressure-pad *K*. A spring stripper *L* lifts the part clear of the die forming block *M* on the up stroke of the ram, thus eliminating drag in feeding the stock. This stripper is forced down in advance of the flanging blocks *H* and *J* by spacers *N*, so that the stripper does not interfere with the flanging op-

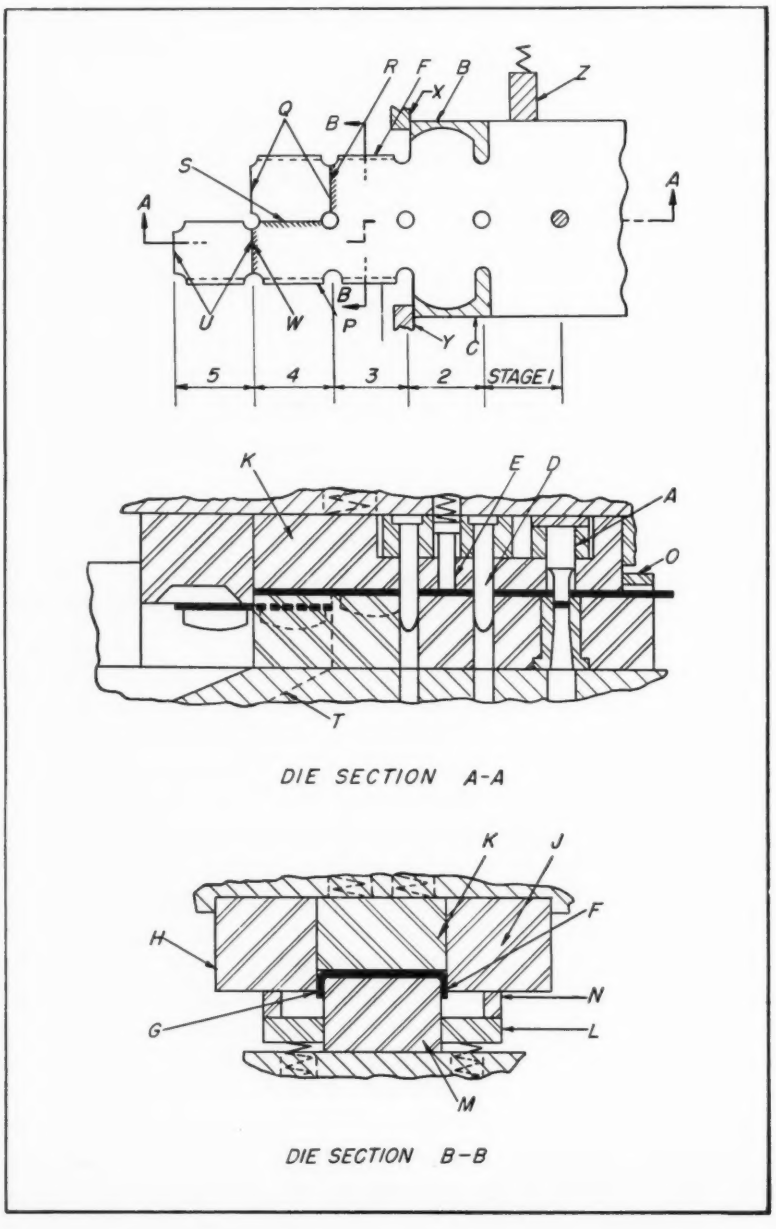


Fig. 1. Multiple Dies Producing Two or More Parts at Every Stroke of the Press are Recommended if Production Requirements are High and Presses of Suitable Capacity are Available

Forming Dies

eration. This advanced action can be omitted if the flange is stiff enough to push the stripper down. Stripper *L* strips flanges *F* and *G* in the second stage and one flange *P* in the fourth stage of the die.

In the fourth stage, the part *Q* is sheared out of the strip along the edges *R* and *S*, sliding off the die area along the inclined surface *T*. Since the two shear cuts run into the pierced hole, it is not necessary for the cut along edge *R* to be in accurate alignment with the cut along edge *W*, which is made in the next stage. Thus, the pierced hole not only acts as a locating hole, but also avoids the necessity of matching cuts in successive die stages, which might lead to excessive trouble with slivers. In the fifth stage, part *U* is cut off at *W* and, like part *Q*, slides off the die along an inclined surface.

If the die is to be fed manually, end or running gages *X* and *Y* will be required. These gages catch against the scrap-metal edges *B* and *C*. After the scrap is trimmed off, the stock strip clears the edges. Also, in a manually fed unit, the pilot-pin *D* would be omitted and the hole pierced in a later stage. The first part made from the strip will be short one-half the width of the notch on the left side. If this is objectionable, preliminary gages can be added.

A spring pusher *Z* may be added to keep the strip at one side of the stock channel for more accurate location. If the die is automatically fed, the end gages *X* and *Y* are omitted, pilot-pins are incorporated in the design, and a hold-down bar *O* is added.

Dies Designed to Produce Parts of Intricate Shape

As the complexity of a part increases, so do the operations required to produce it. Thus, progressive dies for more intricate shapes must be so designed as to provide positive stock feed and accurate location and holding actions, as well as to insure systematic stock and scrap disposal. The greater the number of stages, the thinner the metal stock, or the weaker the strip connecting the various stages, the more difficult it is to feed the stock with pushing rolls only.

Fig. 3. If a Piece is Designed with Long Flanges, it May be Desirable to Blank out the Part Across, Instead of Parallel with, the Strip Stock, in which Case Stock Ribbons Usually are Left on Each Side

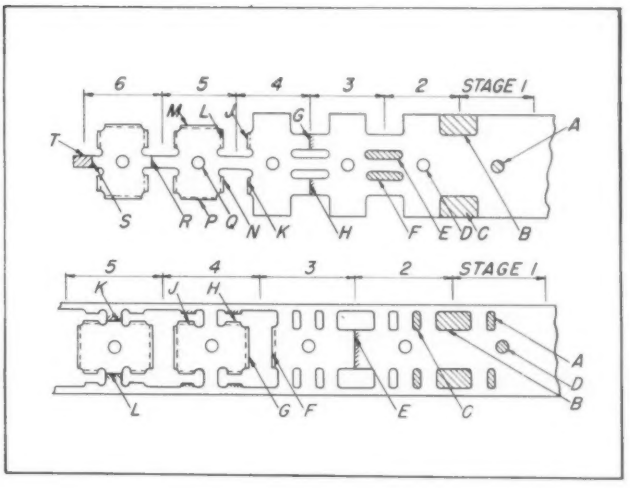
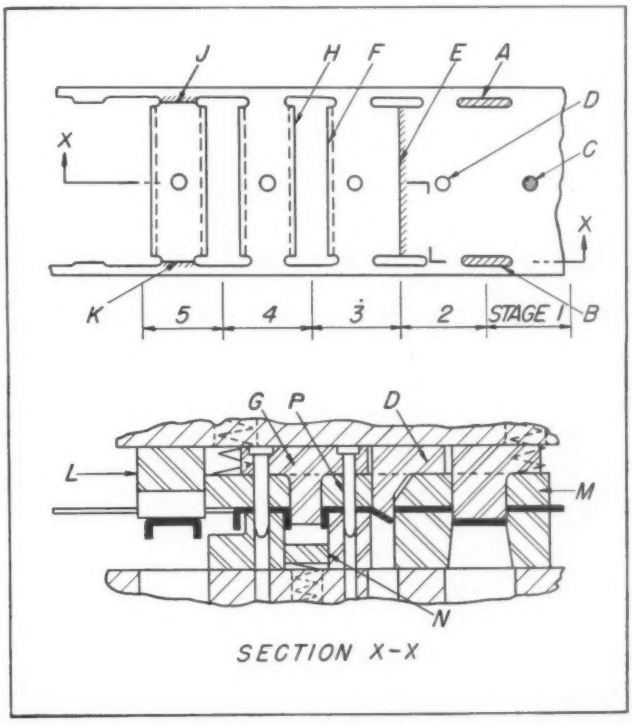


Fig. 2. The Lay-outs Required for a Die Designed for Use with Pushing Feed-rolls and One for Use with Pushing and Pulling Feed-rolls are Shown at Top and Bottom of Illustration, Respectively

It then becomes necessary to design the die so that ribbons of scrap continue through to pulling rolls at the discharge end.

The difference between the lay-out of a multiple progressive die for use with pushing feed-rolls and one designed for use with pushing and pulling feed-rolls is illustrated in Fig. 2. Consider the stock lay-out for the die with pushing rolls, as shown at the top of the illustration.

In the first stage, the pilot-hole *A* is pierced. Between the first and second stages, sections *B* and *C* are blanked out. Between the second and third stages, the slots *E* and *F* are pierced. In



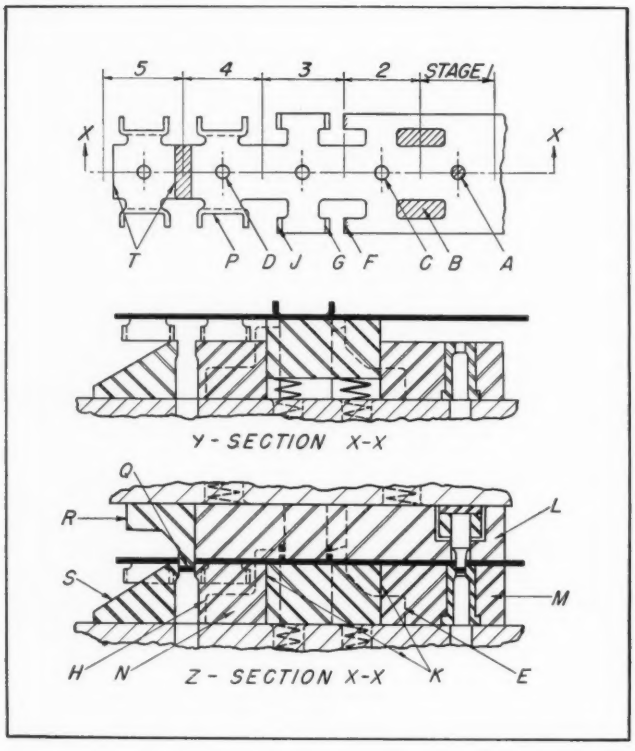
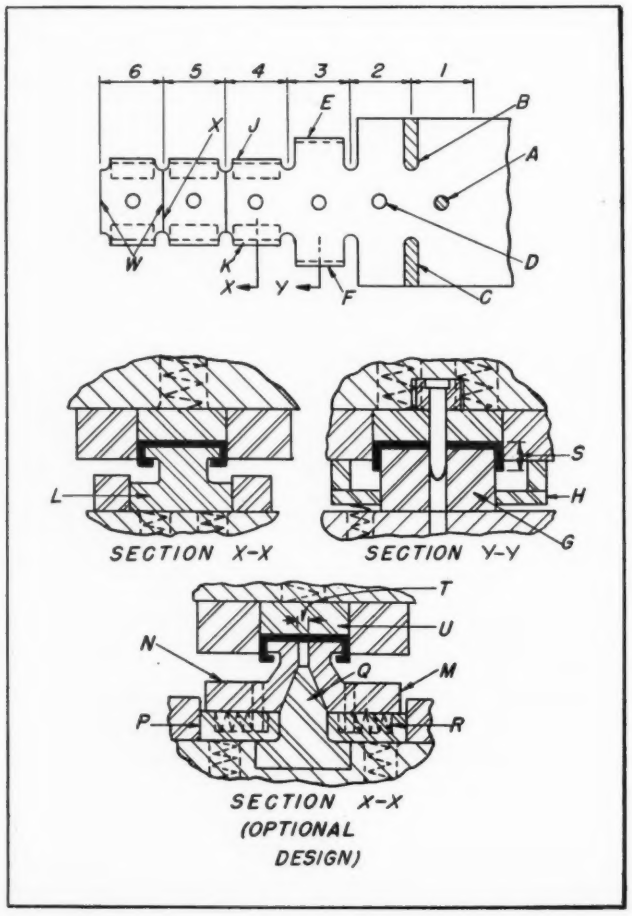


Fig. 4. A Die Similar to the One Shown Can be Employed to Make a Part with Flanges that Extend in Opposite Directions. It is Constructed with Two Pressure-pads K and L, the Upper One of which is the Stronger



the third stage, the strip is sheared at *G* and *H*, and in the fourth stage the flanges *J* and *K* are formed. In the fifth stage, the flanges *L*, *M*, *N*, and *P* are formed, and the pilot-pin enters hole *Q* to locate the strip. Finally, in the sixth stage, the part is cut out of the stock strip by a shearing cut along edges *R* and *S*. The piece of scrap *T* falls off the beveled surface of the die-block or else is pushed free by a spring pin. As in previous dies, a stripper is required to strip the flanges off the die-block.

A lay-out of the same part for push and pull feed-roll operation is shown at the bottom of Fig. 2; the part has been rotated 90 degrees and a ribbon of scrap on each side continues through the die. Relief holes *A*, *B*, and *C* and pilot-hole *D* are pierced in the first and second stages. A shear cut frees the flanges of adjacent parts, as indicated at *E*. In the third stage, the flange *F* is formed, and in the fourth stage, the flange *G* is formed and the flanges *H* and *J* are sheared from the stock ribbon and formed. Finally, the finished part is sheared from the strip along lines *K* and *L*, as indicated. The stock ribbons continue through the die and are cut into scrap by a shearing device beyond the pulling rolls.

In the case of a long part with flanges on its two long sides, a stock lay-out similar to that illustrated in Fig. 3 should be considered. Here the part is blanked out across the strip. The cost of this method of production, as compared with blanking out the part lengthwise of the strip without leaving a stock ribbon, should be considered before the die is designed. The advantage of using a wide strip is that the stock is somewhat cheaper per pound, a greater number of pieces can be made from a coil, thus requiring less coil change, and the die is cheaper. The disadvantage is that the amount of scrap is increased by the stock ribbons.

In the first and second stages of the die shown in Fig. 3, relief slots *A* and *B* and pilot-hole *C* are pierced. In the third stage, the flange metal is sheared by punch *D* along line *E*, and the flange *F* is formed by punch *G*. In the fourth stage, the flange *H* is formed, also by punch *G;* and finally, the part is sheared by punch *L* along lines *J* and *K*.

The upper spring pad *M* holds the stock during the forming and shearing operations and strips the piercing punches. The bottom stripper

Fig. 5. When a Channel is to be Formed on Each Side of a Part, a Die Like Either of Those Shown at X-X May be Used. In One Case, the Die-block in the Fourth Stage is a Spring Pad L, while in the Other Case, it Consists of Two Sliding Blocks M and N Gibbed to a Spring Plate P

N strips the flanges out of the die, so that the stock can be fed without interference. It is forced down in advance of the punches by spacers outside the strip. The blank must be stripped from the straight portion of the pilot-pins P either by use of spring plungers in the pressure-pad or by use of grooved stock lifting plungers.

Die for Flanging Both Upward and Downward

A more complex part in which flanges must be formed both up and down is illustrated in Fig. 4. The action of the die used to produce this part is as follows: In the first stage, the pilot-hole A is pierced, and between the first and second stages the relief slots B are pierced. Pilot-pins are used to locate the strip at C and D in the second and fourth stages. In the third stage, the bottom shearing and flanging die E cuts the metal at F and flanges it at G; the blocks H form the other flange J. These shearing and flanging operations are accomplished as the bottom pressure-pad K is forced down by the upper pressure-pad L, which has considerably more spring pressure behind it. By the time the upward flanging operation is completed, the strip is on top of the solid die piercing block M and the solid die flanging block N.

In the fourth stage, the sides are formed in a downward direction at P by the action of an upper punch as the pressure-pad springs are compressed. A bottom spring stripper, which may be made part of the bottom pressure-pad K, strips the side walls upward and off the die-block N. In the fifth stage, the finished part T is cut from the strip by blanking out a slug Q with the punch R, and the part slides off the bottom cut-off die S.

This type of operation—flanging both upward and downward—usually requires the use of two pressure-pads, one above and one below the strip. The upper pad should be stronger, and the part should, therefore, be located in the die so that the upward flanging or forming operation is easier to perform than the downward operation. This die is designed for automatic roll-feed operations; if manual feed is required, suitable preliminary and running gages should be added.

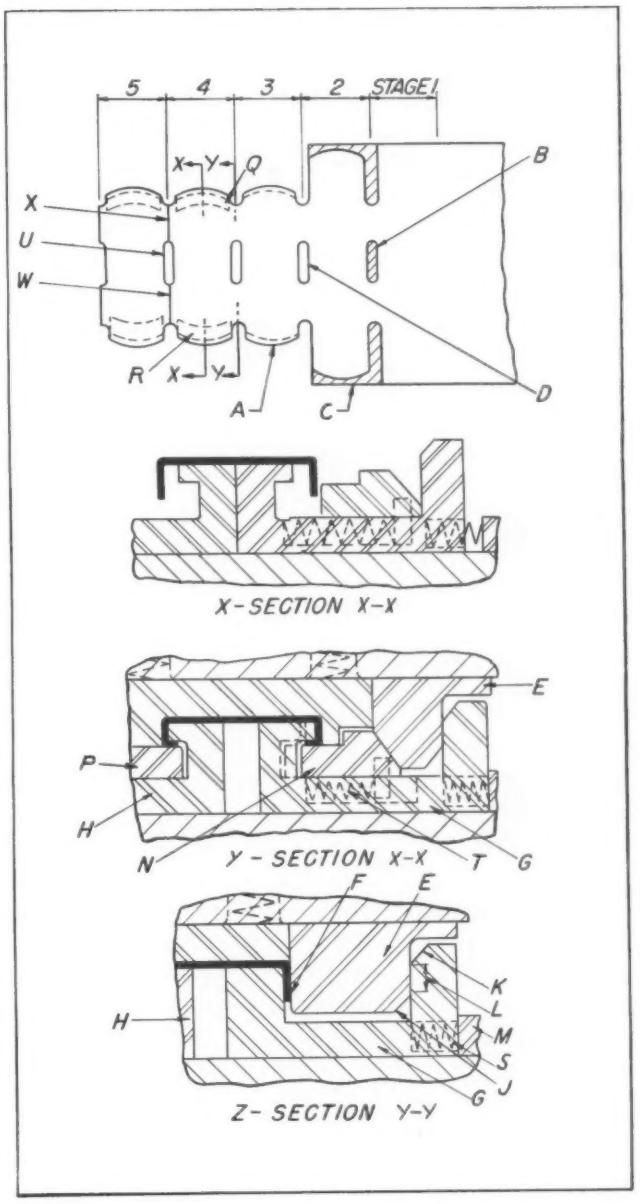


Fig. 6. Curved Channels Can be Formed on the Sides of a Part by Incorporating Slides such as Shown at G, H, N, and P in the Die-block. The Slides are Actuated by the Punch E, and Collapsed by Springs S and T

Progressive Dies Using Cams

Progressive dies can also be designed to produce parts with channels at each side. Such a unit is illustrated in Fig. 5. As usual, the pilot-hole A is pierced in the first stage, and the relief slots B and C are notched between the first and second stages. A pilot-pin locates the strip in hole D in the second stage. The stock is stripped from the pilot-pin by spring pin strippers. In the third stage, two outer flange breaks are made at E and F; the flanges are then stripped from the stationary die-block G by the spring stripper H. In the fourth stage, the two inner flange breaks are made as shown at J and K.

The bottom die-block in the fourth stage may be made in either one of two ways, as indicated by the two sectional views X–X. In the first

view, the die-block consists of a light spring pad *L*, while in the optional design, it is made up of two sliding blocks *M* and *N* gibbed to a spring plate *P* and expanded to the required width of the part by the bottom wedge or cam *Q*. The simpler construction—the spring pad—is objectionable to some extent in that the flanges of the part drag on it, the amount of drag depending on the stock thickness and the sharpness of the flange-break radius. In the case of the collapsing punch construction, the two slides *M* and *N* collapse inward toward each other as the spring plate moves upward. They are gibbed to the plate so that they can travel only inward or outward.

The spring plate *P* travels upward an amount equal to the flange length *S* (see section *Y–Y*), which is also the amount the stock strip is raised in the third stage by the stripper *H*. However, the gap *T* between slides *M* and *N* need be only approximately 1/8 inch. The spring pressure of the plate *P* must be considerably less than that of the upper pressure-pad *U*, so that the strip is down in its final position when the piercing and notching actions occur in the first and second stages.

The fifth is an idle stage, provided to allow space for a solid cut-off block that severs the finished part *W* from the strip stock at *X*. It is poor practice to cut with any spring-operated block such as a spring pad or with cam-actuated slides mounted on a spring plate, because a floating member cannot be guided accurately enough to maintain cutting die clearance.

A somewhat similar part is shown in Fig. 6 except that the break lines *A* of the side channels are not straight. This makes it impractical to use two direct flanging stages, as in Fig. 5. The die designed to produce this part pierces a relief slot *B* between the first and second stages in order to facilitate the cut-off operation in the last stage. In the second stage, a piece of scrap *C* is notched out to permit bending the flange and trimming the edge of the flange to the required contour. A pilot-pin is provided in the second stage at *D*. Next, the channel break *A* is made by the flanging punch *E*, and the entire channel and flange *F* are ironed downward, as indicated at *Z* (section *Y–Y*).

The die-block in the third and fourth stages consist of two slides *G* and *H* that are gibbed to the die-shoe. The angular surface *J* of the punch or cam *E* acts as a driver during the down stroke of the ram to force slide *G* outward by contact with its angular surface *K*. During the dwell, which is indicated by *L*, the slide remains in an outward position against the stop-block *M*. The reason for using the collapsing slides *G* and *H* (as far as the third stage is concerned) is to give the strip a sidewise clearance, so that it can be fed more easily.

In the fourth stage, indicated at *Y* (section *X–X*), the same collapsing action of the bending slides occurs, and in addition, slides *N* and *P* form the channel flanges *Q* and *R*. This action of slides *N* and *P* is necessary, as the flanges are not straight and the edges must be formed by a flanging member. Slide *N* is moved inward by the same member that operates slide *G*. The action of slide *N* takes place during the dwell of

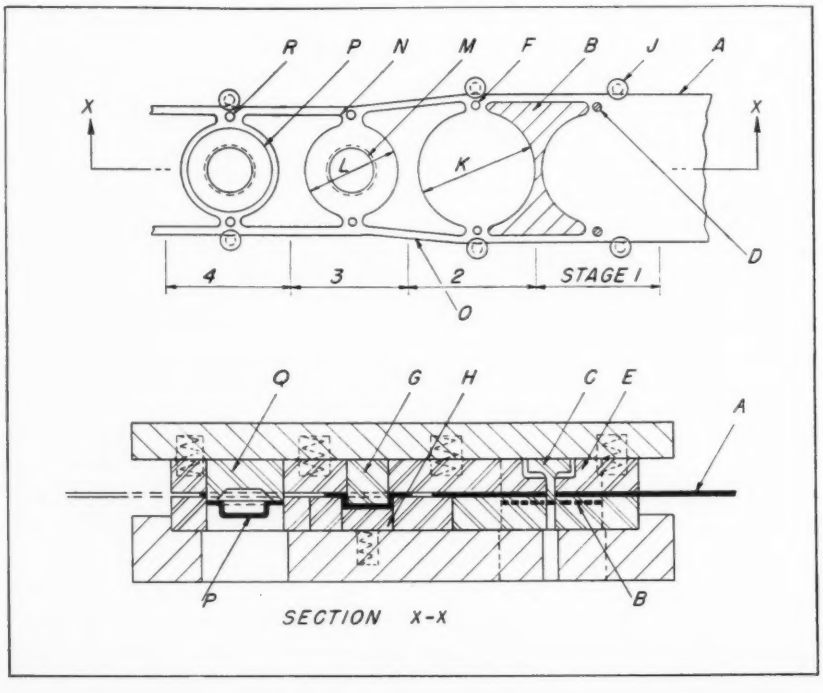


Fig. 7. A Drawing Action is Required to Form the Shape Shown at P. In a Die of This Type, the Distance between Successive Stages Must be Calculated as Accurately as Possible

slide *G*. On the up stroke, slide *N* is forced outward by the spring *T*. Then, following the dwell, slide *G* collapses inward due to the action of spring *S*.

The finished part *U* is severed from the strip by shear cuts at *W* and *X;* these actions are accomplished by an upper cut-off punch that shears on the side of slides *G* and *H*. It can be seen that the pierced slot *B* must be longer than the gap between slides *G* and *H* when they are in an expanded position.

Coil-Feed Drawing and Blanking Die

Drawing, rather than forming, is required to shape the section shown at *P* in Fig. 7. The blank-holder action of a drawing die is necessary to keep the flange of the cup flat and free from wrinkles while the cup walls are being formed. Also, the cup is so deep that the metal required to make the walls cannot be stretched from the flat metal surrounding the cupped area, but must be pulled in from the adjacent region. This movement of metal inward to provide sufficient stock for the cup walls necessitates the piercing of relief holes or slots in a prior stage, so that the spacing between stages is not disturbed.

In the first stage, a relief slug *B* is blanked out by the punch *C* to provide for the subsequent metal movement during the drawing operation. Also, two locating holes *D* are pierced. There is no die action in the second stage, but in the third stage, the punch *G* draws the cup-shaped part. During this operation, the spring pressure-pad *E* acts as the upper binder surface. A bottom stripper plate *H*, operated by light springs, lifts the part out of the die on the up stroke of the ram. The grooved spring pins *J* in the first, second, and fourth stages are also used to lift the strip, and, in addition, strip the stock off the pilot-pins. If the drawn pocket is not deep, these pins can be replaced with locating pins pressed into the die-shoe, the additional lifting action of spring-mounted pins being unnecessary.

The drawing operation pulls stock inward from around the cup and reduces the diameter of the flat blank *K* as indicated at *L* after the cup is drawn. The blank is free to pull in except for a narrow strip which connects it to the two side ribbons *O*. These ribbons are also pulled inward by the drawing action, so that the stock strip becomes narrower at the drawing or third stage. In this stage, it is not advisable to use locating pilot-pins because they tend to stop the flow of metal and tears in the strip may result.

In the fourth and last stage, the part *P* is blanked out of the stock by punch *Q*. The finished part drops through the die and bolster plate. Pilot-pins attached to the punch assembly can be used to locate the part at *F* and *R*.

In a drawing die of this type, the distance between successive stages must be constant, and should be calculated as accurately as possible. When parts requiring a severe draw are to be produced, an experimental model of the drawing stage may be necessary to determine the amount that the blank actually will pull in. Also, in such a die, it is advisable to use segmental die-blocks; and it is good practice to separate the drawing blocks from the blanking or piercing blocks. The die-block for the relief slug *B* should be made in a number of sections for easier replacement.

As has been indicated, progressive dies can be designed to perform almost any operation that can be done in a series of single-stage dies, provided the action—whether forming, drawing, piercing, or blanking—is not too severe. The dies described in this article are representative of those in use by the sheet-metal industries. While there are more complex units, they follow more or less the same design principles as those described here.

* * *

Diamond Research Laboratory

A Diamond Research Laboratory has been established by Industrial Distributors (1946) Ltd., at 44 Main St., Johannesburg, South Africa, to assist all branches of the international diamond industry. The object of the laboratory is to study industrial diamonds, and in cooperation with producers, consumers, and scientific bodies all over the world, find improved and new uses for them in industry. A pamphlet describing the activities of the laboratory can be obtained from Industrial Distributors (Sales) Ltd., Diamond Research Department, Industrial Diamond Information Bureau, 32/34 Holborn Viaduct, London, E.C. 1, England.

* * *

Double seaming rolls with Carboloy rings are being used for crimping and rolling the tops of pails and cans. The carbide rings are mechanically held in a steel body with a steel clamping ring. The average outside diameter of such a crimping roll is 5 inches. The cemented-carbide ring is made in one piece, and is a slip fit over the steel body. The carbide greatly reduces wear incident to the seaming or crimping operations.

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Improved Hard-Surfacing Powder Deposits Chromium Carbide

An improved hard-surfacing powder called "Surfaceweld A" has been made available by the Lincoln Electric Co., Cleveland, Ohio. The powder, applied with a carbon electrode, is used for depositing a thin chromium-carbide type of hard surface that is highly resistant to abrasive wear and corrosion.

The operating characteristics of this material give it a wide field of application. It can be used with an alternating-current arc in connection with a single carbon electrode. It can also be applied with a twin carbon arc or with direct current, carbon electrode negative.

Surfaceweld A is designed for applications where the use of hard-surfacing electrodes is not always practical, as in the case of thin work, thin deposits, or where small alternating-current welders are employed. It is also used in preference to hard-surfacing electrodes for certain conditions of severe abrasion. When mixed with water, the powder forms a paste which adheres to flat and curved surfaces. 201

Silicone Rubber Products for Extreme Temperatures

Gaskets, diaphragms, washers, packings, and numerous other extruded and molded shapes are being produced from silicone rubber by the Stalwart Rubber Co., 157 Northfield Road, Bedford, Ohio. This new material has been developed specifically to meet the critical demands of many high- and low-temperature applications in which resiliency is of primary importance. Silicone rubber looks and in many ways acts like conventional rubber, and it retains rubber-like qualities and elasticity at temperatures ranging from —150 to 500 degrees F.

In addition to being suitable for dielectric applications, silicone rubber parts are resistant to permanent compression even under extreme heat, and withstand the effects of prolonged weathering. They are also water-repellent, which enables them to maintain high surface resistivity under moisture condensing conditions. Silicone rubber parts also resist lubricating oils and some chemicals.

Parts made of this material are expected to have wide application in such products as electric irons, industrial ovens, steam generators, gas cylinders, oil burners, jet and conventional aircraft engines, electrical heating equipment, electric motors, and die-casting machines...202

Extreme-Pressure Lubricant with Molybdenum Content

"Molykote," a new type of dry lubricant manufactured by the Alpha Corporation, Greenwich, Conn., consists essentially of molybdenum disulphide powder and has the appearance of graphite, although it contains none. Numerous tests have shown it to have an extremely low coefficient of friction and an unusual capacity to prevent galling, seizing, or metal-to-metal contact at bearing pressures well over 100,000 pounds per square inch and high or low sliding velocities. With light rubbing, it adheres tenaciously to even the smoothest surfaces, which suggests its use as a factory applied lifetime lubricant for mechanical articles. When used on screw fasteners or in press fits, assembly takes place smoothly, without binding, at increasing torque. 203

Color Buffing Compound for Carbon and Alloy Steels

A new bar composition, known as 6-B-72, for color buffing carbon steel, stainless steel, and chromium plate has been developed by the Hanson-Van Winkle-Munning Co., Matawan, N. J.

In order to produce a good color on these metals, free from cloud or cast, it is necessary that the compound produce a very light and soft face on the buff with sufficient lubrication to prevent scratching. This composition has a binder that retains the abrasive on the buff face for a greater period of time, permitting it to do its

cutting and yet not build up a heavy waxy face, which would prevent a high color. It produces a high finish on carbon and stainless steels and at the same time cuts out imperfections left from the cutting down operations. It will also rapidly cut and color burned chrome. 204

Cold Solder Fills Casting Crevices and Seals Joints

Applied with an ordinary putty knife, free spreading Lab-Metal, manufactured by Alvin Products, Inc., 20-22 Houghton St., Worcester 4, Mass., fills blow-holes, sand-holes, surface blemishes, and rough or porous places in metal castings. The solder hardens rapidly into a strong permanent bond that can be sanded to a feather edge, ground, and painted without requiring heat or special tools. It can be thinned with any regular lacquer thinner, and can be brush painted or sprayed on. 205

Thermal Barrier Materials Withstand High Temperatures

Two new and improved thermal barrier materials capable of withstanding temperatures as high as 2800 degrees F. have been added by the American Latex Products Corporation, 921 Venice Blvd., Los Angeles 15, Calif., to its line of "Stabond" cements, adhesives, and allied compounds. These sealing compounds, known as Stabond FR 8 and FR 10, are obtainable in various consistencies for application by trowel, brush, or extrusion gun. In a test conducted by a leading aircraft manufacturer, an oil tank covered with a 1/8-inch coating of FR 10 withstood a 2000-degree F. flame blast for thirty-six minutes without damage to the underlying metal. The metal of an unprotected tank was burned through by the same flame in one-half minute.

The new compounds are particularly suitable for application as an insulating material to electrical junction boxes, heat exchanger couplings, and similar points. They will prove valuable for lagging steam pipes and hot-air ducts wherever resistance to vibration as well as heat is a desired characteristic. They may also be used as an abrasion-resistant coating for electrical systems. 206

Tape Type Adhesive Film Provides Metal-to-Metal Bond

An unsupported film of pure adhesive which provides a metal-to-metal bond that is resistant to shear tests up to 3500 pounds per square inch has been developed by the Minnesota Mining & Mfg. Co., 900 Fauquier Ave., St. Paul, Minn. The material is called "Scotch-Weld" bonding film, and is furnished in rolls like tape. It is transparent and roughly resembles cellophane in appearance. In use, it is placed between units to be bonded and is cured by simultaneous application of heat and pressure—a heat of 300 to 500 degrees F. for five to sixty minutes and a pressure of 25 to 100 pounds per square inch, both varying with the type of bond desired.

The manufacturer's tests reveal shear strengths up to 3500 pounds per square inch in bonding 0.064-inch aluminum Alclad to itself. In bonding the same metal to fiber, wood, and plastic surfaces, the non-metallic materials delaminated at 880, 1770, and 2800 pounds per square inch, respectively, but the adhesive did not fail. 207

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on these pages, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in February, 1949, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on the blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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Automatic Loading Devices for Gear-Finishing Machines

A line of automatic loading devices for gear-finishing machines designed to suit different production requirements has been developed by the Michigan Tool Co., 7171 E. McNichols Road, Detroit, Mich. These devices, which automatically reduce idle time of machines to two seconds per gear, or less, are adapted for use on both rack and rotary type gear-finishing machines, and can also be applied to Michigan machines already in use.

The equipment developed eliminates manual handling and the necessity for mounting gears and pinions between centers, special pneumatic headstock centers now being available in which the center acts as an arbor. Stripping the work from the center is also accomplished automatically. Production rates as high as 300 pinions an hour for each machine are being obtained with these automatic devices. In general, the loading devices fall into three major classes—gravity chute feed and unload type for the smaller gears; chute feed and indexing mechanism with positive loading; and jaw type loaders for the larger gears and cluster type gears.

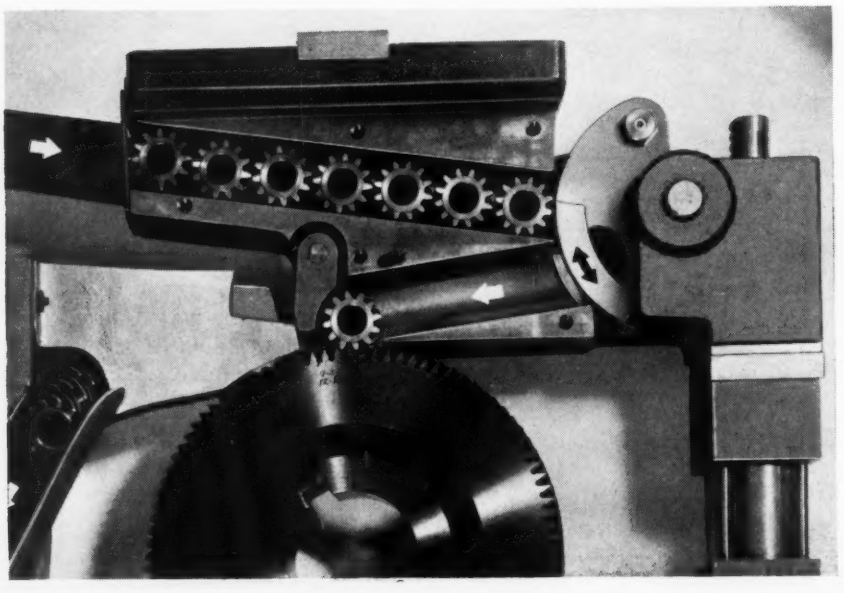
In the accompanying illustration is shown a gravity chute feed for the rotary shaving of pinions at the rate of 300 an hour. With this feed, one operator can easily take care of several machines. All Michigan loading devices are electrically interlocked with the machine cycle to insure stopping the machine in case any part fails to function correctly. One indexing feed for pinions on rack type shavers loads the work so rapidly that operation is continuous.

A jaw type loading device for large gears and clusters is available for use on either rack or rotary machines. Conveyor-equipped installations for finishing the gears on a cluster automatically, without manual handling, and one under-pass type and three rack machines are now available.

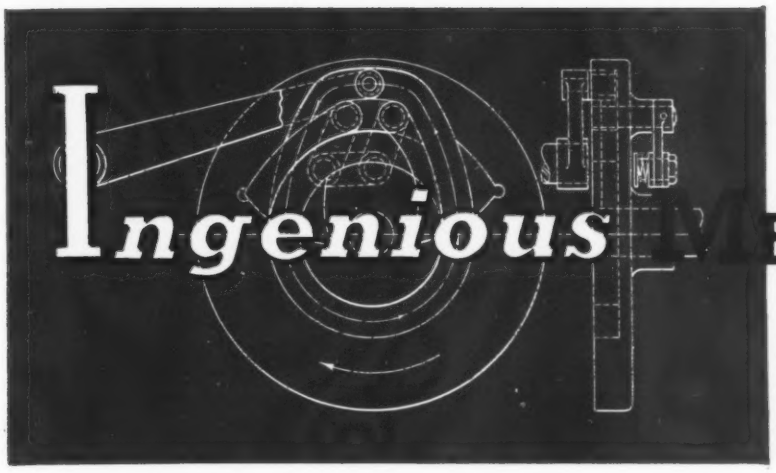
Referring to the gravity-feed loading device illustrated, the pinions to be shaved are loaded into a chute, either manually or mechanically. They roll down this chute, as indicated by the arrows, the first gear entering the shuttle rotor. The opening in the shuttle is designed so that when the gear is lowered to the second chute, the end of the upper chute is closed off. Thus, only one gear at a time can enter the second chute.

When the shuttle is in the "down" position, a mechanically actuated lever positions a finger above the shaving cutter so that the gear can roll into mesh with the cutter. With the gear in this position, the pneumatic headstock center comes into action and enters the hub of the gear with a light press fit thus serving as an arbor. The stationary tailstock center locates the gear axially. The tailstock is provided with a "power" linkage to insure travel of the center up to a fixed position for each operation.

The machine next goes through the cutting cycle while the finger moves back out of the way and the shuttle returns to receive another gear. At the end of the cycle the headstock center retracts, stripping the gear from the arbor, after which the rotary cutter turns slightly, rolling the gear off into the exit chute. The next gear then enters the second chute and the operating sequence is repeated. This device not only reduces the amount of labor required, but also increases the output of the machine.



Automatic Gravity Chute Feed for Rotary Shaving Machine Operated at a Production Rate of Three Hundred Finished Gears per Hour



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Geneva Wheel Designed for Precise Intermittent Indexing Movements

By W. PONT

The chapter on intermittent motions in MACHINERY'S book "Ingenious Mechanisms" prompted the writer to submit the design for a modified type of Geneva wheel that was developed to obtain precise intermittent indexing movements. This special mechanism, shown diagrammatically at *J* in the accompanying illustration, was designed to eliminate any backlash or over-running action of the driven member *F* at the end or beginning of each indexing movement, when the pin *A* of the driving member *E* enters or leaves the slot in one of the arms of the driven member *F*. The relative positions of the driving and driven members at the start and end of the indexing movement are shown in the diagrams *J* and *L*, respectively.

With the mechanism designed as shown, the driven shaft *H*, keyed to wheel *F*, is indexed one-fourth revolution for each revolution of the driving shaft *G*, which is keyed to wheel *E*. Each indexing movement starts smoothly as the long driving pin *A* enters one of the slots in wheel *F* and pin *C* passes out of contact with the flange on the rim of wheel *F*.

The driving pin *A*, as shown in section *X–X*, is long enough to make contact with the sides of the slots in wheel *F* for the full depth or thickness of the slotted part of the wheel. The two shorter pins *B* and *C*, one of which is shown in section *Y–Y*, are made to clear the bottom of the recess machined in the under side of wheel *F*, as shown in section *Z–Z*, but are not long enough to contact the straight sides of the slots contacted by pin *A*.

The pins *B* and *C* are so positioned, however, that they make close running contact with the flange formed by the recess on the under side of wheel *F* (see the broken section *Z–Z*). The flange *D*, machined integral with wheel *E* to a close running fit with each of the four segments of wheel *F*, has a 90-degree section cut away opposite the driving pin *A* to provide clearance space for the projecting arms of the driven wheel during the indexing movement.

Referring to the diagram at *J*, pin *A* is just entering a slot in wheel *F*, while pin *C* is passing out of contact with the rim on the under side of wheel *F*. The pin *C*, being a close running fit on the inside of the flange on wheel *F*, and flange *D*, being a close running fit on the outside of the flange on wheel *F*, serve to hold wheel *F* stationary until the indexing actually begins, and also prevent it from further movement the instant the indexing is terminated. During part of the revolution of driving wheel *E*, the flange *D* alone serves to hold the driven wheel stationary in the dwell position, as indicated in diagram *N*.

The accurate positioning of pin *C* also prevents any movement of wheel *F* before pin *A* engages a slot. Thus the indexing movement of wheel *F* is started with a smooth, accelerating motion and stopped as smoothly with a decelerating motion without any over-run or backlash.

Diagram *K* shows the mechanism with the driven wheel *F* rotated through one-half of the first indexing movement, at which point it has reached its maximum speed of rotation.

Diagram *L* shows the the driven wheel at the end of the indexing movement, with the short pin *B* of the driving wheel making contact with the flange on the under side of the driven wheel, so that it holds the outer side of the flange in contact with flange *D* of driving wheel *E*. Thus pin *B* prevents any rotational movement of the driven wheel as driving pin *A* leaves the slot in the driven wheel at the end of the indexing movement.

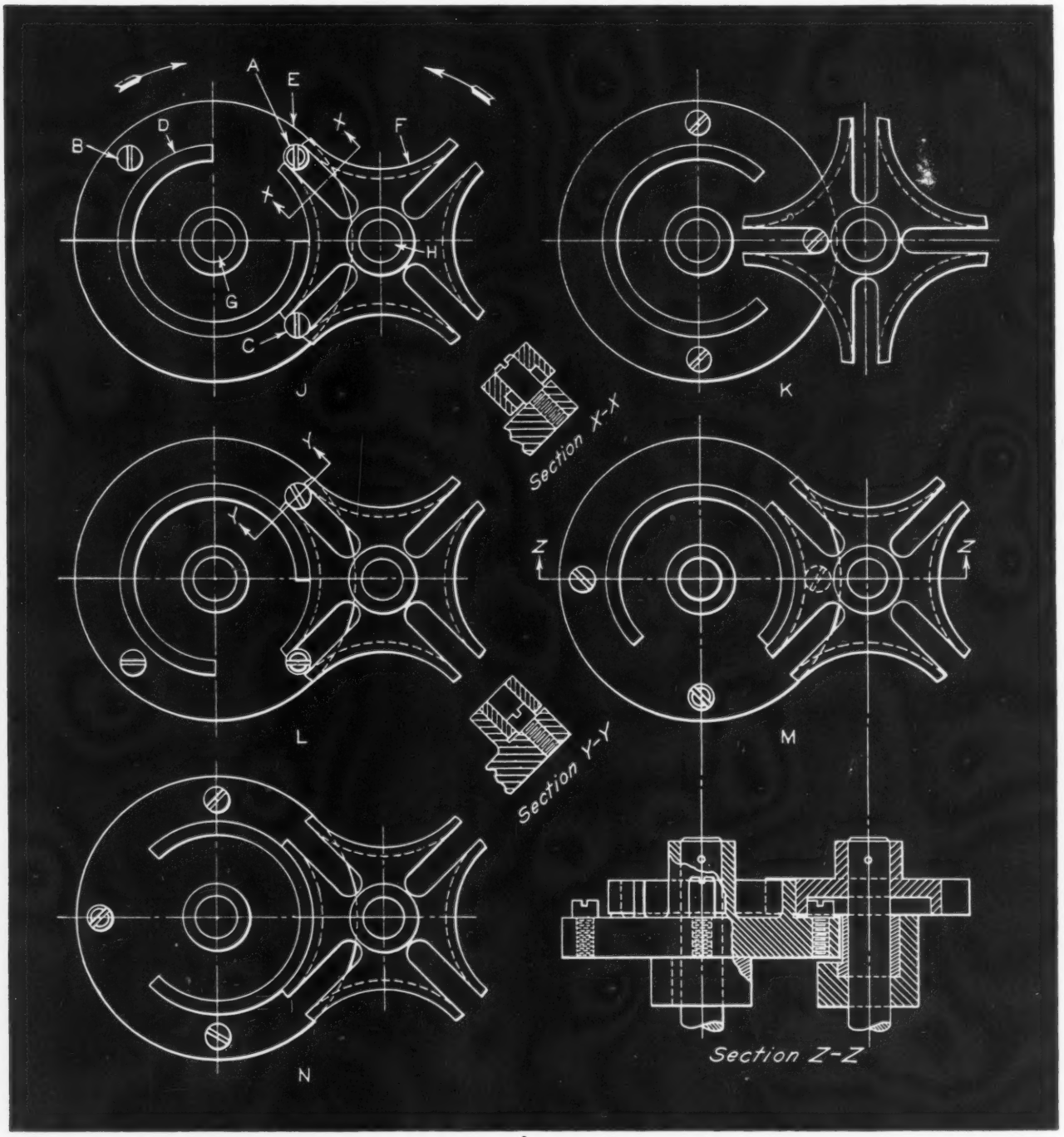
The diagram at *M* shows the driven wheel in the dwell position with pin *B* still in contact

with the flange on the under side of the driven wheel. The broken section *Z–Z* shows the short pin *B* clearing the recess in the driven wheel, which is held stationary in the dwell position. Section *Z–Z* is broken, part of the view to the left being shown in full lines, in order to indicate the difference in the heights of the driving pin *A* and the two pins *B* and *C*.

The diagram at *N* shows the driven wheel still in the dwell position, where it remains stationary until rotation of the driving wheel *E* brings pin *C* and driving pin *A* into the positions indicated in diagram *J*. The indexing movement and dwell period described are then repeated, driven wheel *F* being indexed one-fourth turn for each complete revolution of driving wheel *E*.

* * *

"Tin" cans are actually 98 1/2 to 99 per cent steel, with a very thin layer of tin.



Diagrams Illustrating the Operation of a Geneva Wheel Designed for Precise Intermittent Indexing Movements, in which the Driven Wheel F is Indexed One-fourth Revolution for Each Revolution of the Driving Wheel E

Tool Engineering Ideas

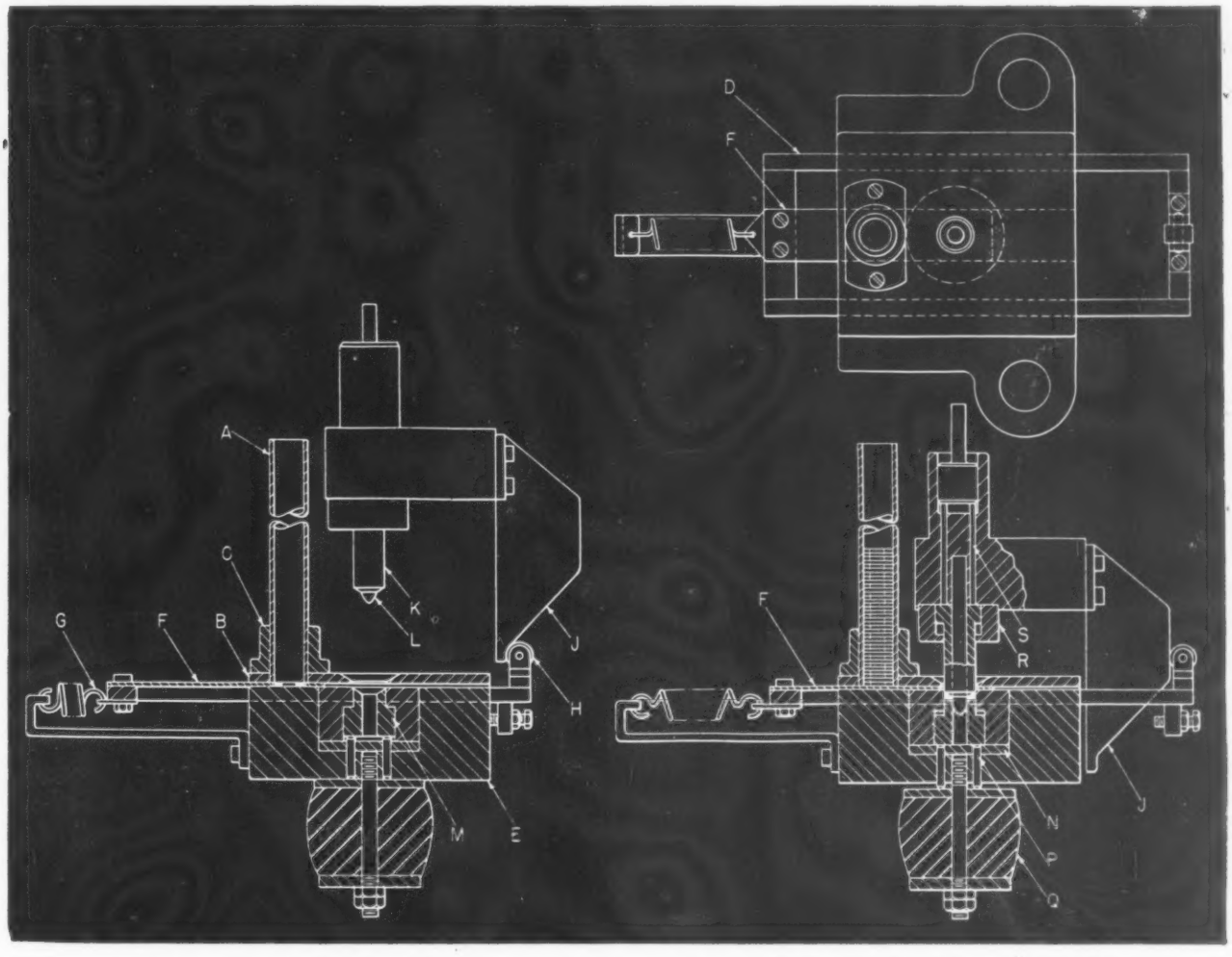
Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Coining Die with Automatic Feed

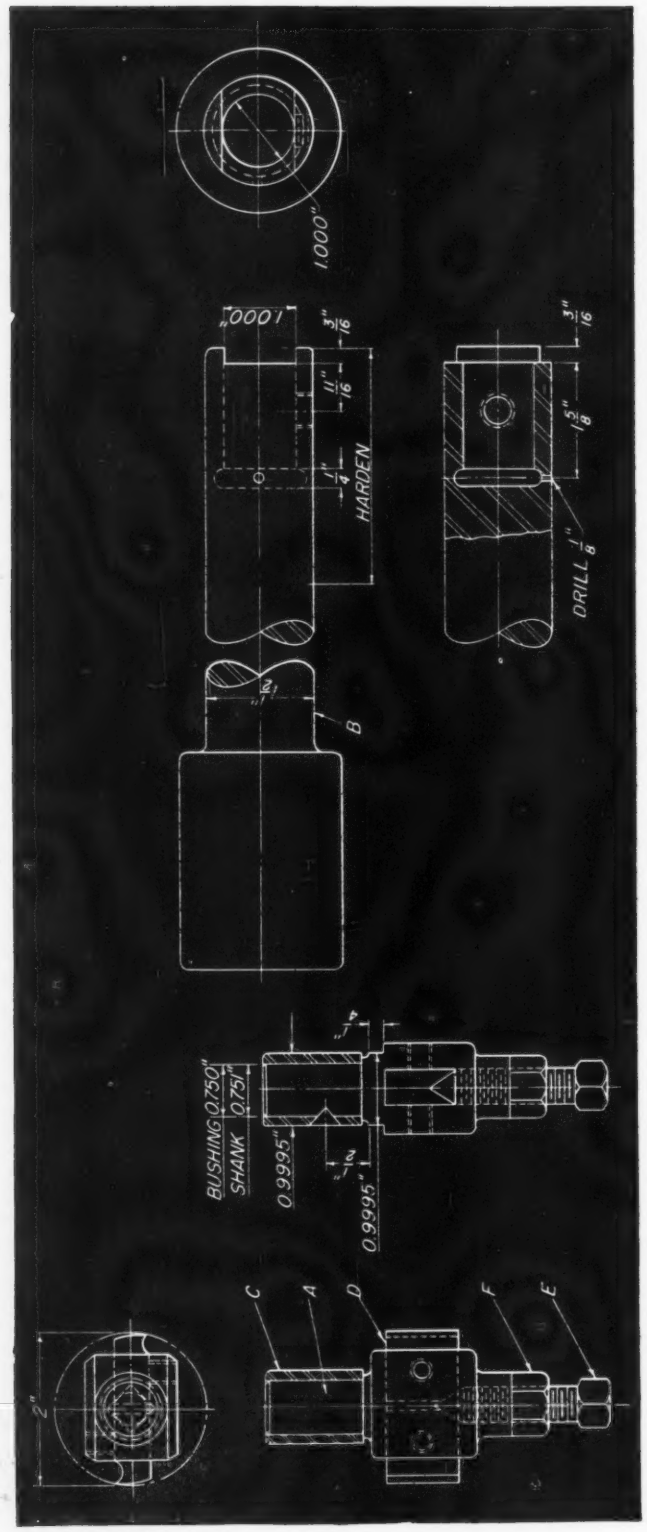
By EDWIN MOSTHAF, Consulting Engineer, Orange, N. J.

A coining die capable of forming 3600 washers an hour is shown in the accompanying illustration. After being blanked and pierced in a previous operation, the washers are stacked in a tubular feed hopper *A*, which has a bore slightly larger than the outside diameter of the work. The tube extends through plate *B*, and is secured by the flanged bushing *C*. Plate *B* is used to retain the slide *D*, which travels freely through two tracks in the die casing *E*. A tapered recess directly over the die cavity is provided in the plate to facilitate removal of the washers after forming.

The work-carrier *F* is assembled to the center section of slide *D*, as shown in the plan view of the die, and is guided through a channeled section in the under side of the plate. A hole in the carrier for picking up the work is in direct alignment with the bore of the tube when the slide is in the loading position. It can be seen that the carrier and the channel in which it rides are of the same thickness as one washer. This insures the feeding of only one washer at a time to the die. At this point, it should be mentioned that a phenolic resin plastic material, such as



Coining Die for Forming Washers, with a Slide and Hopper Mechanism for Automatic Loading



Universal Boring-bar Consisting of a Blade-holder A and a Bar B. This Tool Can be Equipped with Blades of Different Sizes to Bore Holes of Various Diameters

Bakelite, was used instead of steel carriers in order to eliminate damage to the punches caused by possible misalignment.

A spring *G* is connected to one end of slide *D* to hold the carrier in the loading position. A roller type cam follower *H* is secured to the opposite end for engagement with the cam *J*, which is fastened to the punch-holder. The down stroke of the press moves the cam face against the roller and thus actuates the slide. The carrier, containing one washer, is pulled into position over the die just before punch *K* enters the work. The punch is provided with a pilot *L* to insure alignment of the washer with the punch and die.

At the forming position, the die *M* is supported on a backing plate *N*. Two pins *P* that come in contact with the under side of the die travel in clearance holes in the backing plate and the die casing to compress the rubber stripper pad *Q*. The clearance in the punch-holder *R* permits the punch to remain in the die during the up stroke of the press ram. This affords a means of holding the punch on the work until the pilot is free. Two ejector rods *S*, which contact the punch to hold it in the die during the beginning of the up stroke, are actuated by a standard knock-out assembly (not shown).

When the punch starts its upward travel, the forming die is free to move up under pressure from the stripper pad and thus bring the work in position to be removed by an air blast.

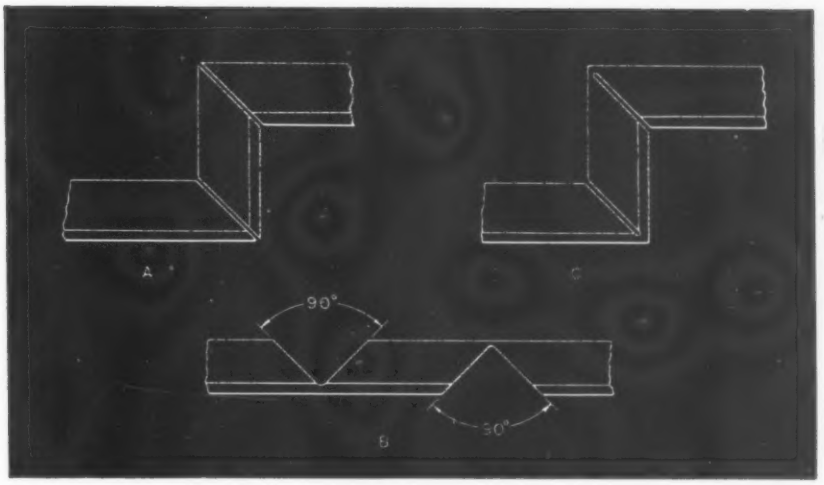
Universal Boring-Bar for Turret Lathes or Radial Drilling Machines

By HAROLD E. MURPHEY, Westerly, R. I.

A universal boring-bar that can be provided with different blades to bore holes of various diameters is an extremely useful tool for application on turret lathes or radial drilling machines. Such a tool is shown in the accompanying illustration. It consists of a cast-iron blade-holder *A* and a bar *B* into which the blade-holder fits. The bar is made of cold-rolled steel and is surface-hardened at the end. A hardened tool-steel bushing *C*, shrunk onto the shank of the blade-holder and ground in position, prevents wear of the shank if the holder is removed frequently.

The position of blade *D* is adjusted by the set-screw *E*, which is locked in place by nut *F*; set-screws are used as shown to hold the blades in place. In this particular case, the blades can be adjusted to bore holes from 2 to 2 1/2 inches

The Ordinary Method of Forming Simple Bends in Angle-irons is to Cut the Parts to the Required Angle as at A, Clamp Them, and Weld Them Together. If a Piece is Notched as at B, it Can be Bent as Shown at C and No Clamps are Necessary for the Welding Operation. A "Tack" Weld at the Cut Opening Opposite the Bend will Keep the Work Rigid while the Notch is Filled in With Weld Metal



in diameter; larger diameters can be bored by simply inserting a larger set of blades. The bar *B* shown in the illustration is designed for use in a turret lathe, and is standard equipment for blade-holder *A*. By making the bar with a tapered shank instead of a straight shank, it can be used on a radial drilling machine.

The blade-holder fits into the end of the bar and is held in position by a set-screw. A small drilled hole acts as an air vent when the blade-holder is pushed into place. To eliminate movement of the holder, it is ground flat and parallel on two sides. These flat surfaces fit into a slot ground in the bar.

Welding Angle-Irons without Clamps

By GUSTAF S. BECKMAN, Cranston, R. I.

When angle-irons, flat strips, or special steel shapes are used to make frames for jigs and fixtures or production parts, two or more pieces must often be welded together to form simple bends. The common method of accomplishing this is to cut the pieces to the required angle, as indicated at *A*, clamp them together, and join them by welding.

However, the pieces can be cut in such a way as to eliminate the necessity for clamps. Instead of cutting entirely through the piece, it can be notched in the form of a vee, leaving a small section of metal at the edge, as shown at *B* in the accompanying illustration. If a 90-degree bend is to be made, a 90-degree notch is cut in the angle-iron; the included angle of the notch always equals the angle of the bend. The notches can be cut on a metal band saw, provided the part clears the limits of the saw; otherwise, they can be cut by a slotting cutter on a milling machine.

The part is then bent as at *C* until the two edges are abutted. There is sufficient metal at the base of the notch to hold the parts during welding without the use of clamps, and yet the section is weak enough so that the bend can readily be made.

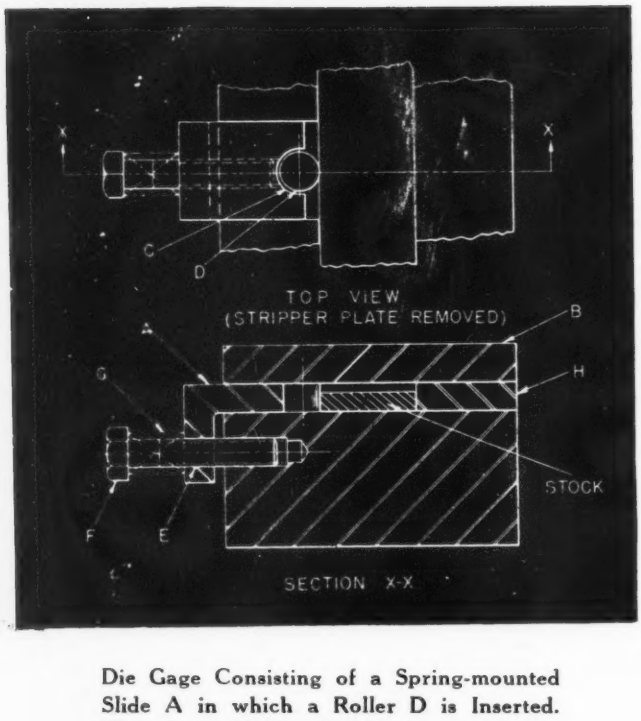
Roller Stock Gage that Increases Die Accuracy

By ROGER ISETTS, Kenosha, Wis.

In designing blanking and piercing dies, it is necessary to provide some method of holding the stock securely against the back-gage of the die to take up any discrepancies in width and thus insure more accurate parts. Several varieties of complicated mechanisms for doing this are in general use. The gage shown in the illustration (see page 202) differs from those gages usually employed in that, while efficient and accurate in operation, it is quite simple in construction. It prevents the stock from weaving between the front and back gages, and also insures that all holes will be an equal distance from the back edge of the work.

The gage consists of a slide *A*, which is made of hardened tool steel machined to an angle shape. One leg of the angle is finished so that it slides freely underneath the stripper plate *B*. A hole *C* is drilled and reamed near the end of the angle, the center being slightly back from the front edge of the leg. A roller *D* is then assembled in this hole. In the other leg, a hole *E* is drilled to receive a hexagonal-head cap-screw *F*. Roller *D* is made of hardened drill rod, its height being exactly the same as the thickness of the top leg of slide *A*.

To assemble the gage, all the toolmaker need do is to insert roller *D* into slide *A* and lay the



Die Gage Consisting of a Spring-mounted Slide A in which a Roller D is Inserted. This Gage Holds the Stock against the Back-gage H, thus Preventing it from Weaving and Insuring Greater Part Accuracy

slide in the slot in the front gage. The hexagonal-head cap-screw and a spring *G* hold the slide in place. When the stripper plate is assembled, it is impossible for the roller to fall out, even though it is not an integral part of the slide.

In use, the operator merely inserts the stock between the front and back gages. This causes slide *A* to move back against spring *G*, the pressure of the spring forcing the stock against the back-gage *H*. The gage is compact, positive, and will insure the production of identical pieces. It is an easy matter to vary the dimensions to suit virtually any thickness of stock.

Scribing Tool for Circular Parts

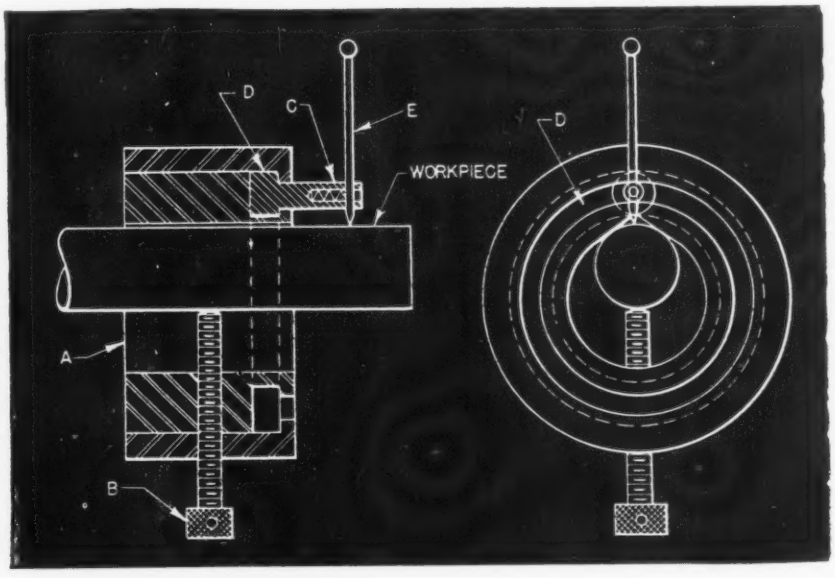
By H. MOORE, Leeds, England

The usual method of scribing a circle around a shaft or tube is to chuck the part in a lathe and touch it lightly with a sharply pointed tool, but this cannot be done when the work lacks centers, is exceedingly long, or is oval in shape. In such cases, a scribing tool of the design shown in the accompanying illustration can be applied.

This device consists of a collar *A*, which fits over the work and is held in position by tightening screw *B*. A holder *C* for the scriber fits into a T-slot *D* machined in the collar, and is free to rotate around the circumference of the work; part *C* is drilled to receive the scriber *E* and a tension spring that holds the scriber in position.

To mark a work-piece, the scriber is first located in the correct position, the screw *B* is tightened, and the scriber run around the work. Pressure is put on the ball end so that, even though the T-slot is not concentric with the part, the scriber follows the contour of the working surface.

The tool is accurate, simple to use, and easily made. Since the collar is made in two parts, the most difficult operation—that of machining the circular T-slot—is reduced to straight turning and boring. The internal part of the collar is bored, turned, and grooved, after which the outside section is bored to a diameter that will be a drive fit on assembly with the inner part. The outside section is also machined with a shoulder that mates with the grooves in the internal part and forms the T-slot in the collar. To complete the tool, a shallow vee is cut, against which the work-piece is seated.



Scribing Tool which Consists of a Collar A that Fits over the Work and a Scriber E that Can be Rotated to Mark Shafts or Tubes that are Exceedingly Long, Lack Centers, or are of Irregular Shape

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Liability for Rental Value of Substitute Equipment

A. C. Y.—In delivering a machine to a purchaser, our truckdriver passed a red traffic light at the intersection of two streets and collided with another truck whose owner is suing us for $2000. This amount includes $1450, which he claims was spent renting a substitute truck while his truck was being repaired. Are we liable?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

Yes, you are liable for full damages. For example, in Holt vs. Pariser [54 Atl. (2d) 89], a company sued to recover damages resulting from a collision between its truck and a truck belonging to another company. The company whose truck was damaged asked the court to allow it $2304.54, of which $516.54 was for cost of repairs and $1788 for hire of a substitute truck until repairs were completed. The higher court awarded full damages.

Calculating Helix Angle of Gears

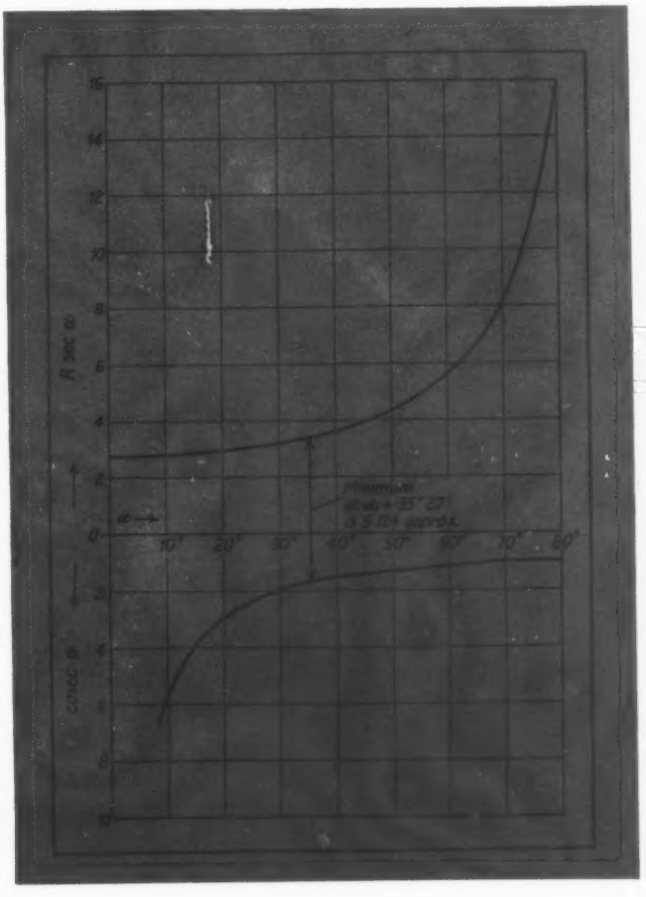
J. R. H.—In calculating a pair of helical gears where the shafts are to be at right angles, the ratio of number of teeth in the large gear to the number of teeth in the small gear is to be more than one, and the center distance is to be exact, considerable difficulty has been encountered in determining the exact helix angle for a pair of gears with the following specifications: C (exact center distance) = 4.132 inches; P_n (normal diametral pitch) = 8; n (number of teeth in small gear) = 13; N (number of teeth in large gear) = 36; and R (ratio of teeth) = $\frac{N}{n}$ = 2.76923.

The method suggested in MACHINERY'S HANDBOOK (Thirteenth Edition, page 816) is that a —the exact helix angle of the large gear—can be found by successive trial and error, using various values of a until the right-hand side of the following formula is satisfied:

$$R \sec a + \operatorname{cosec} a = \frac{2CP_n}{n}$$

A.—Using the values given, the right-hand side of the formula $\left(\frac{2CP_n}{n}\right)$ will equal 5.08554. There cannot be a solution of this problem because the expression (R sec a + cosec a) does not, for any value of a, have a value less than about 5.124. Such a minimum value is due to the fact that R sec a increases as a increases, while cosec a decreases as a increases.

This is shown graphically in the accompanying diagram, where R sec a is measured upward and cosec a is measured downward. The value of (R sec a + cosec a) for any value of a is the vertical distance between the two curves. It is evident, therefore, that if the exact center distance of 4.132 inches is to be maintained, the value of one or more of the quantities P_n, n, or N must be changed.



THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER Sales Engineering Consultant

Visual Aids in Selling Machines

COMPETITIVE conditions make it vital that every sales engineer devise better methods to sell by using every possible visual display of his wares. Obviously, we cannot pack a machine tool in the back of our automobile, carry it into the plant, and place it before the prospective purchaser. But we can use visual evidence, selected for the occasion.

Catalogues and Technical Literature—The old-time sales engineer limits his sales tools largely to illustrated literature, photographs, and technical data. These are the easiest to carry and display. They come all prepared by the factory. Habit has long since established their usefulness. Since the prospective purchaser must largely use his own effort in analyzing them, there is a great tendency to depend upon them altogether. The sales engineer may leave with the feeling that he has done his job by handing the prospect "all the dope." If the customer fails to read what is furnished, either he is at fault or the literature is inadequate or unconvincing. Don't just thumb over such printed matter in the prospect's presence. Sell it.

Samples of Machine Parts—Almost every machine tool possesses some small and perhaps intricate part that is vital to the operation or novel in design. This can be taken along and effectively displayed. It can serve as an illustration of progressive design, accuracy, or man-hour reducing ability; or it may be used to symbolize how every part of the entire machine possesses the stamp of quality, which the live salesman will interpret in terms of results to the customer.

Sample of Machine Tool's Work—Probably the best sample of all is what the machine will do. Of course, the sales engineer can't take with him the "before and after" of a large casting. But in many instances he can carry a small sample or section of work done. Such samples are very effective if they display result factors. They must, however, be accompanied by reliable data on quantity and cost of production—not based on ideal conditions, but on the actual conditions of use in the prospect's plant.

Models—Scale models have become increasingly useful in selling. They not only act as visual aids, but give relative dimensional information, which greatly assists factory lay-out plans, particularly where space requirements are important.

Displaying Tools in Operation—We have all seen operations on large work where the machine tool itself is taken to the work rather than the work to the machine. In the sales of many machine tools, similarly, we must take the prospect, himself, to a machine installed and operating in some other plant. If conditions in the plant visited are right, no form of "sample display" is better than this.

Quotations and Proposals—Some sales engineers don't recognize that the letter, quotation, or proposal is one of the most important sales tools. I have repeatedly seen a purchasing engineer review some ill-formed quotation or involved proposal with considerable annoyance. The elements of a good quotation or proposal are: Logical arrangement; brevity; clarity; completeness; and good appearance.

The proposal can actually be a "silent salesman." It matters little how you like it—the all-important point is how the prospect likes it. On complicated jobs, the proposal is invariably passed from one to another in the purchaser's organization. That's why it is well to provide a summary, enabling the non-technical personnel to grasp the points quickly.

All these sales tools are elemental. To the alert and successful sales engineer they are ABC's. But how many of us actually make use of these different visual sales tools? The sales engineer must remember that it is one thing to select proper sales tools and another to use them effectively. Further suggestions on the use of visual aids will be given in a subsequent article.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

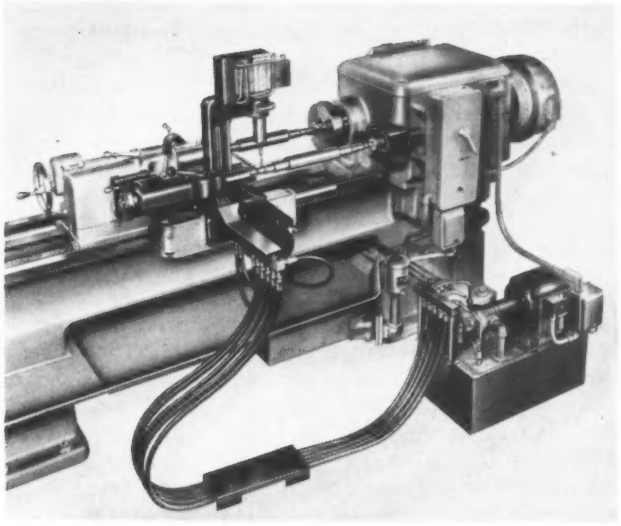


Fig. 2. Rear View of Hydraulic Control Tracer Unit of "Copymatic" Lathe

Lodge & Shipley "Copymatic" Tracer-Controlled Dual-Purpose Lathe

The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio, has announced a new tracer-controlled dual-purpose lathe known as the "Copymatic." This machine embodies an all-hydraulic tracer control in the company's standard Model X 16- and 20-inch medium- and heavy-duty, and 25-inch medium-duty lathes. The ease with which these lathes can be converted from standard operation to automatic duplication, and vice versa, is an outstanding feature. The change-over is accomplished almost instantaneously by turning two valves and closing a switch.

On duplicating work, the tracer will operate from round or flat templets, doing any type of form-turning or boring jobs within the range of the lathe. It can be used in reproducing multiple-diameter shafts or holes with sharp shoulder faces, grinding necks, tapers in both directions, chamfers, and contours. Operations of this kind can be performed quickly and with a high degree of accuracy.

The swing capacity of the standard lathe is maintained because the regular compound-rest and cross-feed screw assemblies are used and are directly connected to the hydraulic piston operating within the cylinder mounted on the rear of the lathe carriage. This feature, together with the fact that nothing needs to be removed or replaced in changing from one type of opera-

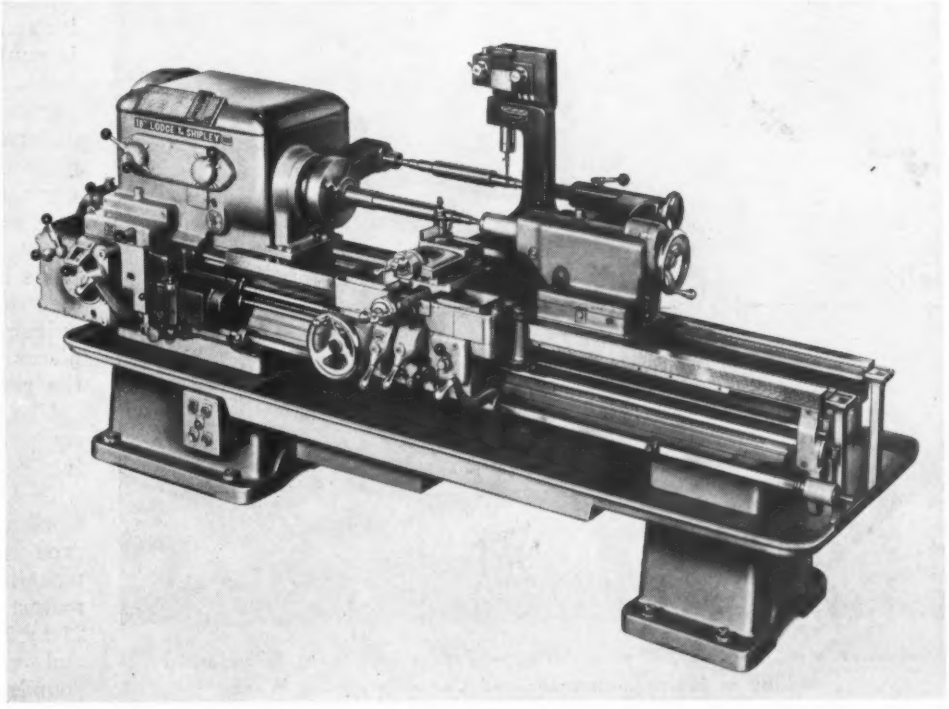


Fig. 1. New "Copymatic" Tracer-controlled Dual-purpose Lathe Built by Lodge & Shipley Co.

To obtain additional information on equipment described on this page, see lower part of page 238.

tion to the other, makes these lathes truly dual-purpose machines and removes them from the "special-purpose machine" class.

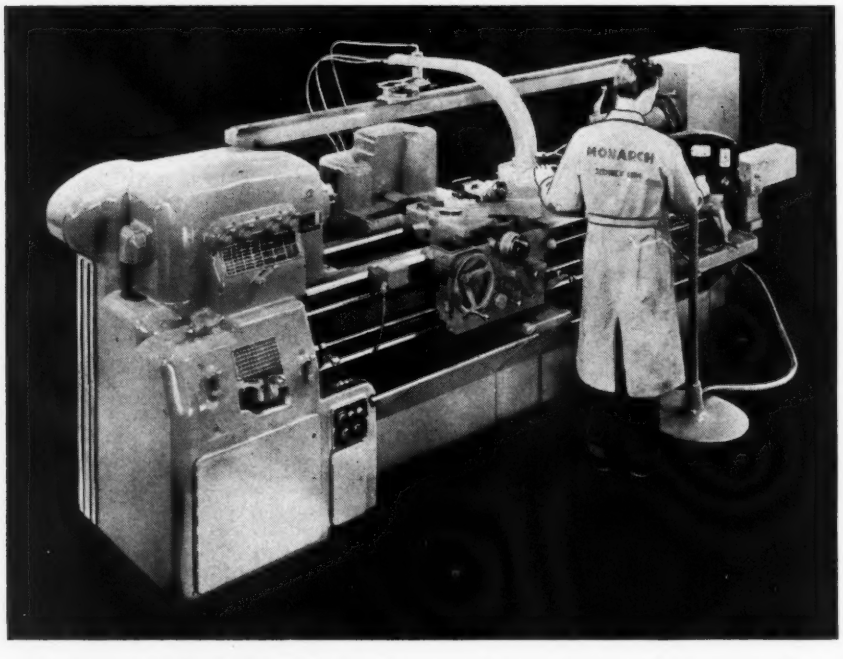
The hydraulic tracer equipment furnished on the "Copymatic" includes a hydraulic pump and motor, Purolator, air filter, tracer head and one stylus, valves and switches, hydraulically operated clutch and brake for longitudinal feed, hydraulic piston and cylinder for cross-feed, and supports for the templets. 61

"Air-Gage Tracer-Packaged Unit" for Monarch Lathe

A new "Air-Gage Tracer-Packaged Unit," designed to increase production and decrease costs on multiple-diameter and contour-turning work, has been developed by the Monarch Machine Tool Co., Sidney, Ohio. The new development is a refinement of the original lathe accessory introduced in 1947. It provides a combination of the features of a modern flexible engine lathe and the high-production advantages of automatic cycling, together with templet control of size and contour of the work.

The unit is designed for application to Monarch 16- and 20-inch Series 60 engine lathes, 20-inch Model M, 25-inch Model N, and 32-inch Model NN engine lathes. It includes an electrically controlled motor drive coupled to the right-hand end of the leadscrew. The control system provides stepless variation of the carriage feed rate in a range of 1/2 inch to 20 inches per minute. A floor stand carrying the control panel for the unit can be located in the most convenient position for the operator. This panel contains switches for energizing the control, and starting, stopping, and reversing the cycle, as well as controls for setting the infinitely variable feed.

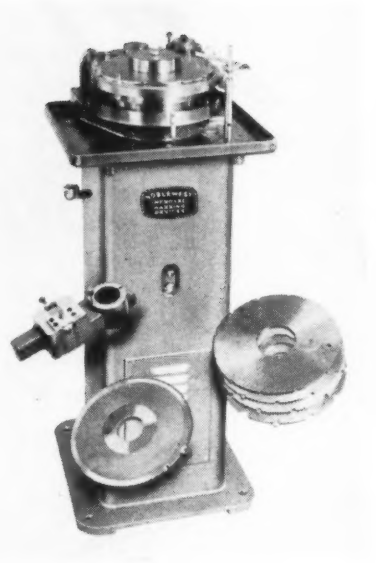
A large indicator, calibrated in inches per minute, facilitates selection of the exact feed desired, and provides a visual check on the feed. An interval timer provides accurate control over the starting of the carriage feed in proper synchronism with the "air-gage tracer" controlled cross-feed. Adjustable stops are provided for stopping the feed and starting and stopping the rapid traverse as required for the part being machined. 62



Monarch Lathe Equipped with Air-gage Tracer for Rapid, Economical Handling of Multiple-diameter and Contour-turning Work

"Noblewest" Roll-O-Matic Marking Machine

A new model Roll-O-Matic dial-feed marking machine has been announced by the Noble & Westbrook Mfg. Co., 15 Westbrook St., East Hartford 8, Conn. This machine will mark inscriptions permanently on both flat and round work at production speeds of 3000 to 4000 pieces per hour, depending upon the size and nature of the work-pieces.



Roll-O-Matic Marking Machine Built by the Noble & Westbrook Mfg. Co.

Through the use of interchangeable marking heads and work-carrier dials, the machine can be set up for marking parts of a variety of shapes and sizes. It is suitable for trademarking, codifying, and part numbering of metal, plastic, wood, or fiber components, and has a capacity for handling parts from 1/4 to 5/8 inch in diameter. The machine is equipped for marking flat surfaces on five different sizes of parts and round surfaces on two different sizes of parts. A complete change-over from one style work-piece to another can be accomplished by the operator in about five minutes. After the parts have been marked, they are ejected automatically, the only requirement being to feed the work-pieces into the proper location on the revolving dial.

The machine, as illustrated, is equipped with two different marking heads, one head being used with flat dies for marking round work and the other head with roll type dies for flat work. The machine is driven by a 1/3-H.P. motor, occupies a floor space of 21 by 26 inches, is 40 inches high, and weighs approximately 500 pounds. 63

To obtain additional information on equipment described on this page, see lower part of page 238.

Brown & Sharpe Surface Grinder Equipped with New Automatic Lubrication System

Brown & Sharpe Surface Grinding Machines

The Brown & Sharpe Mfg. Co., Providence 1, R. I., has brought out two surface grinding machines adapted for use under exceedingly dusty or severe operating conditions. The new machines, known as Nos. 2L and 2LB, have full automatic lubrication for all moving parts and surfaces, and the table sliding surfaces are completely guarded from abrasive dust.

The No. 2L machine has automatic feeds and the No. 2LB has hand feeds only. Both machines have the same capacities and operating features as their companion surface grinding machines, Nos. 2 and 2B, described in March, 1947, MACHINERY, page 191. They are furnished with a drive from the motor in the base or with a motorized spindle.....64

Tap Designed for Threading Plastic Materials

The Hy-Pro Tool Co., New Bedford, Mass., has developed a multi-fluted tap for threading holes in all plastic materials. This new tap is said to consistently produce smooth threads of uniform size and remain sharp after continuous usage, cutting threads in plastics that are hard or soft and that have either cloth or glass fillers. 65

South Bend Tool-Room and Quick-Change Gear Lathes

A new series of 13-inch swing tool-room and quick-change gear lathes is now being manufactured by the South Bend Lathe Works, 383 E. Madison St., South Bend 22, Ind. New features include an improved headstock spindle with increased bore and collet capacity, a new tailstock base with improved bed-way wiper system, and a new one-point oiling system for reverse-lever bracket and twin gear bearings.

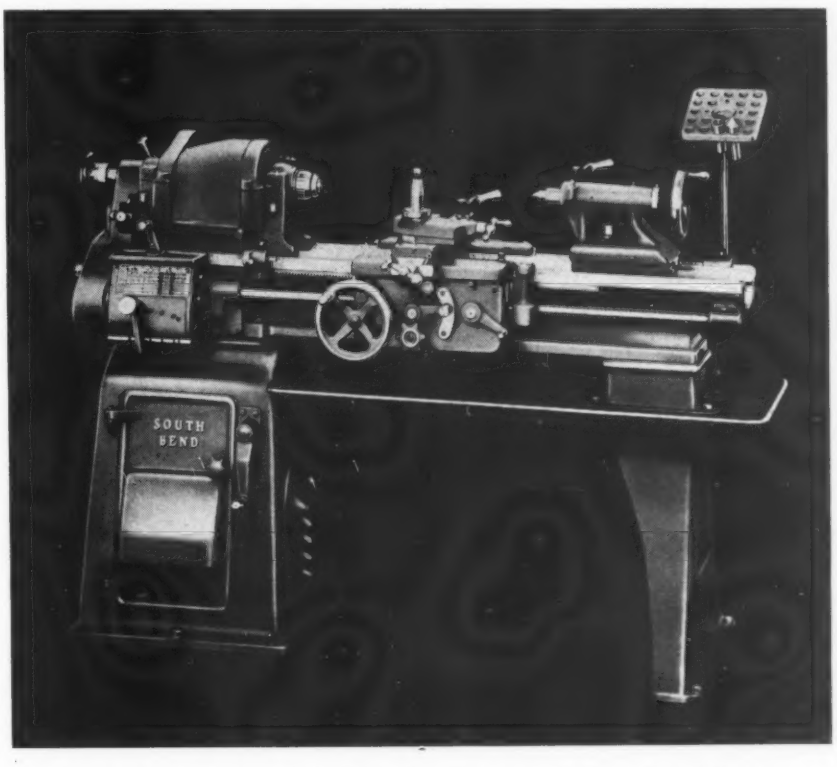
The new headstock spindle has a 1 3/8-inch bore and will take No. 5 South Bend collets, which have a maximum capacity of 1 inch. The bearing surfaces on the spindle are superfinished to a smoothness of 5 micro-inches (profilometer reading 0.000005 inch r.m.s.) and have a hardness of 56 to 61 Rockwell C.

Large individual oil reservoirs and an improved capillary oiling system provide a complete film of clean filtered oil. The oil is returned to the reservoirs from the bearings so that only an occasional replenishing is required. Reservoir drains are provided so that they may be flushed clean periodically. The new tailstock-base wiper system is designed to keep the bed ways for the tailstock base free of chips, grit, and dirt.

An unusually wide range of spindle speeds is provided. The belt drive to the spindle is silent in operation and develops smooth, steady power, entirely free from gear vibration. All the lathes in the new series are equipped with the South Bend quick-change gear-box and double-walled apron. The underneath motor drive is entirely self-contained and fully enclosed.

General specifications are: 13 1/8-inch swing over bed; 7 3/4-inch swing over saddle cross-slide; forty-eight screw-thread pitches, 4 to 224 per inch, right or left hand; forty-eight longitudinal power feeds, 0.0015 to 0.0841 inch right or left hand; forty-eight power cross-feeds, 0.0006 to 0.0312 inch; eight spindle speeds, 34 to 875 R.P.M.; 4-, 5-, 6-, or 7-foot bed lengths.

The No. 5 South Bend collets used are available in sixty-one fractional capacities down to 1/16 inch for round stock. Decimal sizes, metric sizes, and square or hexagon No. 5 collets can be supplied on special order. 66



Quick-change Gear Lathe Brought out by South Bend Lathe Works

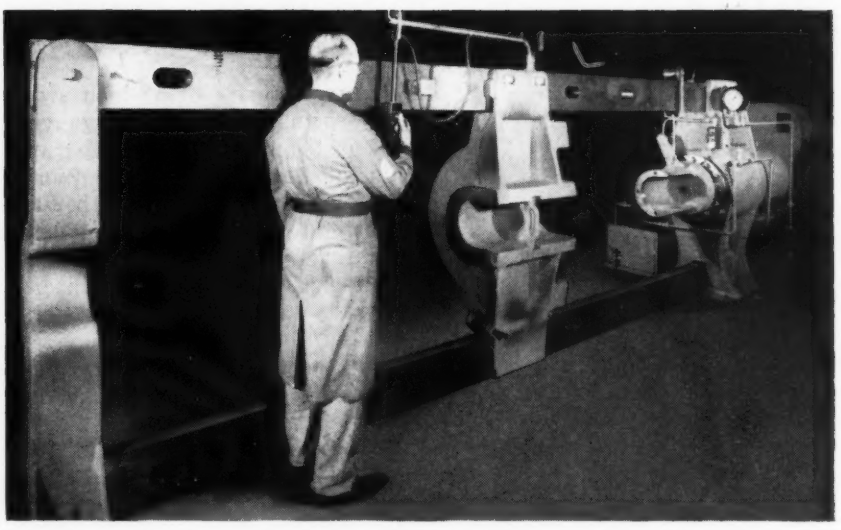
To obtain additional information on equipment described on this page, see lower part of page 238.

H-P-M Self-Contained Hydraulic Wheel Press

To facilitate assembling or removing wheels, pulleys, gears, and other parts which have been pressed on shafts or arbors, the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has developed a new line of self-contained hydraulic wheel presses with capacities ranging from 50 to 600 tons.

A typical press of this line, which is used extensively in railroad shops and heavy machine industries, is shown in the accompanying illustration. This press has a 48-inch clearance between bars, 128-inch maximum daylight capacity, and 24-inch ram travel. The resistance yoke is equipped with a stop-block which is used for making contact with the end of the axles when mounting wheels. A throat block is provided on the end of the ram to obtain clearance for the axle when forcing on wheels. Remote push-button operating control, mounted on a swinging arm, enables the operator to control the press-ram movement from the most advantageous position.

An exclusive feature of this press is a power unit which consists of an H-P-M variable-delivery, oil-hydraulic pump for direct electric motor drive. When high pressures are required, the booster unit serves to double the normal pressure generated by the variable-delivery pump. The combination of variable-delivery pump and booster assures a smooth, uniform pressure. 67

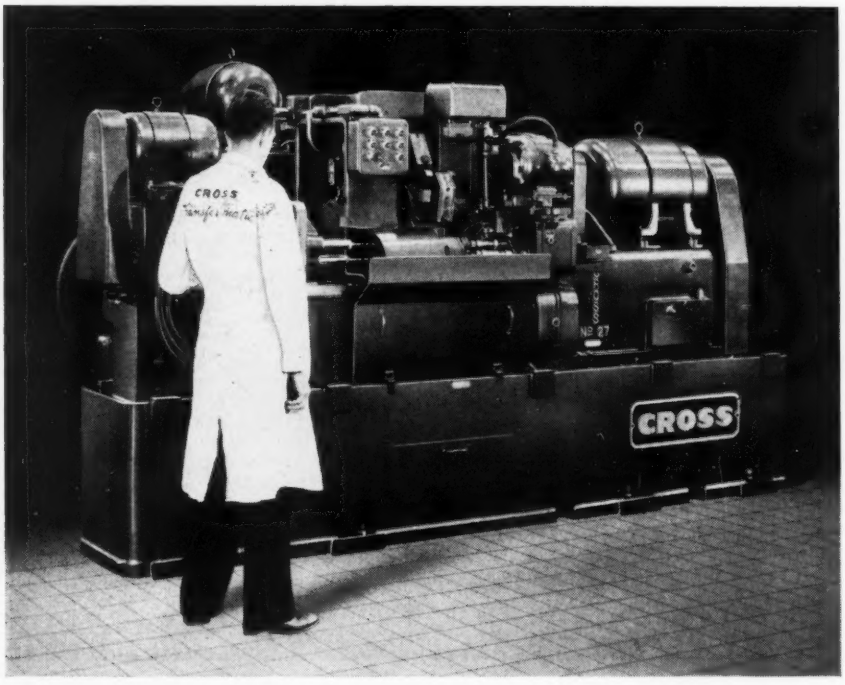


Self-contained Hydraulic Wheel Press Brought out by Hydraulic Press Mfg. Co.

Cross Machine Designed to Finish Oil-Pump Bodies

The Cross Company, Detroit 7, Mich., has developed a machine designed specifically to reduce the cost of finishing oil-pump bodies. Operations performed in finishing the pump bodies at the rate of sixty-three per hour include milling both ends, drilling two mounting holes on the left-hand end, drilling and tapping four cover holes on the right-hand end, drilling and reaming two bearing holes, roughing and semi-finishing two gear pockets, and forming a pressure relief cavity.

The machine has a ten-station, power-operated index trunnion, with an independent station for loading and unloading while in operation. It cuts nine pieces at a time progressively. Special features include fluid-drive indexing with overload protection; automatic relief for milling cutters during the return stroke; hydraulic feed for drilling, reaming, and milling; and lead-screw feed for tapping. 68

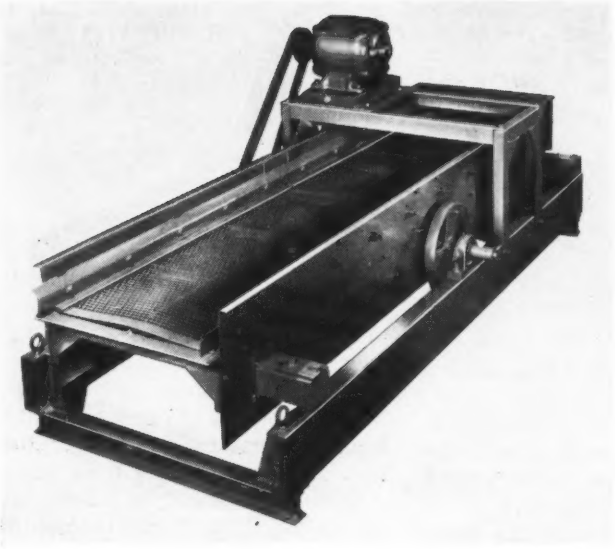


Machine Developed by The Cross Company for Finishing Oil-pump Bodies

"Moldisc" Wheel for Rotary Sanders

A bonded disk wheel for rotary sanders, known as "Moldisc," has been announced by Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J. It was designed to meet the need for a bonded wheel for portable grinding tools that would last longer than a coated abrasive sanding disk and, at the same time, be easier to handle than the flaring cup wheel. Fast, free-cutting qualities adapt this wheel for use in fabricating stainless steel and other alloys which must be ground and finished without generating excessive heat. Supplied in a 7 inch diameter, 1/4-inch thick size, with a 7/8-inch hole. 69

To obtain additional information on equipment described on this page, see lower part of page 238.



Single-deck "Mighty-Mite" Power-operated Screen for Small Parts

Pipe Cutting-off Machine Brought out by the Oster Mfg. Co.

Vibrating Screens

A new line of light-duty "Mighty-Mite" vibrating screens has been brought out by the Screen Equipment Co., Inc., Buffalo 21, N. Y. Single- and double-deck models are available in a variety of sizes, and triple-deck models are made in the smaller sizes. The screen has a positive eccentric action and a maximum vibration amplitude of 3/16 inch.

These vibrating screens require a driving motor of only 1 to 2 H.P., and are operated at speeds up to 1150 R.P.M. They will take loads up to 15 tons per hour, depending upon the type of material to be screened and the size of the wire-cloth openings. 70

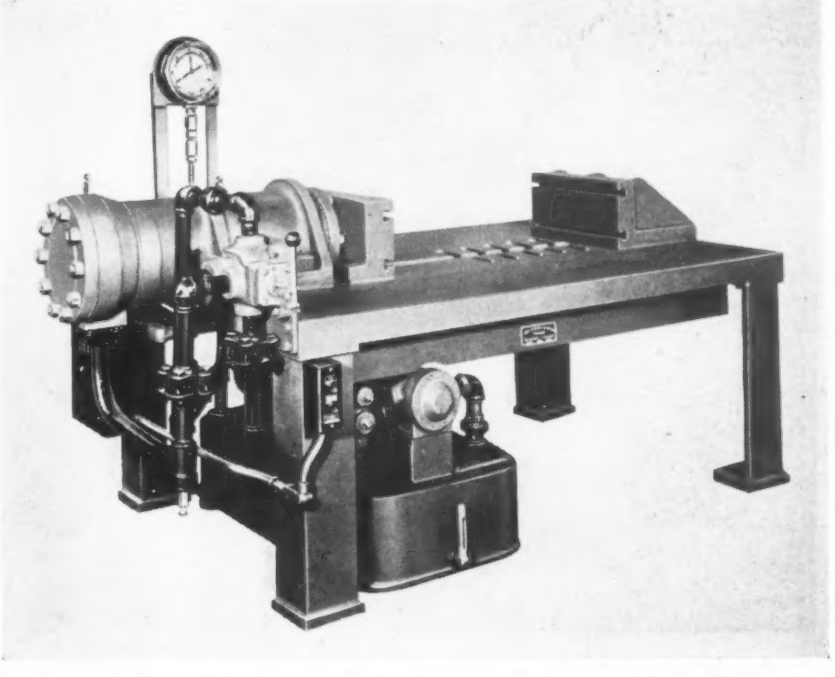
Pipe Cutting-Off Machine and Receding Die-Stock

The Oster Mfg. Co., 2057 E. 61st St., Cleveland 3, Ohio, has brought out a No. 662 "Cut Master" machine designed for cutting off pipe from 1/4 inch to 2 inches, inclusive. As many as 60 pieces of 2-inch or 150 pieces of 1/2-inch pipe can be cut off by this machine in ten minutes. The 1/2-H.P. 10,000-R.P.M. universal variable-speed, geared-head motor is designed for light-socket operation. The cutter wheel is moved up or down by a hand-wheel and feed-screw, which reduces the effort of the operator to a minimum.

Rollers with needle bearings support the work, minimizing friction and permitting the pipe to turn freely. The rollers are grooved to prevent breakage of cutter wheel, which is ground to reduce the burr formed on the pipe to a minimum. The machine weighs 225 pounds.

Wood Horizontal Hydraulic Bending Press

The R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa., has recently brought out a self-contained 30-ton press designed for general shop work in bending and straightening bars, rods, light structural sections, and similar work. This press is adapted for use in maintenance and machine shops, railroad repair shops, and structural and electrical shops. It has a work-table 3 by 4 feet in size, and weighs approximately 6000 pounds. To facilitate handling certain types of work, the machine can be mounted on one end and used as a vertical, downward moving type press. 71



Wood Hydraulic Bending Press for Maintenance and Machine Shop Work

To obtain additional information on equipment described on this page, see lower part of page 238.

Another new product of this company is a geared receding die-stock known as the "Leader No. 54." This new pipe-threading tool is built to withstand the strain imposed when used with a drive-shaft for power operation with a portable pipe machine. A ratchet handle is employed for operating the tool by hand

The tool is furnished with four sets of dies, each having five replaceable segments. Each set of dies will thread one pipe size only. The four pipe sizes are, 2 1/2, 3, 3 1/2, and 4 inches. 72

"Industrial Lowerator" for Work and Material Handling

The "Industrial Lowerator" announced by the American Machine & Foundry Co., 485 Fifth Ave., New York 17, N. Y., has been developed to eliminate the manual lifting of loaded tote boxes or the lifting of materials to working levels. These automatic spring-powered racks hold a bank of material and bring the work to the level of the operator's hand as soon as the preceding piece or group of pieces has been removed. Thus the flow of parts or material is continuously timed to suit the worker's individual capacity and production is speeded up.

The cut-away view of the Lowerator in the foreground of Fig. 1 illustrates the manner in which the work is stacked so that the upper layer or row of parts can be kept at the most convenient height for handling. The chain and helical spring arrangement that actuates the unit is shown in the background. To reload, the material is simply placed on the platform after which it automatically finds its proper level. Being actuated by springs the rack requires no outside power source and is smooth in action and noiseless. Actually it serves as a combination material-handling, storage, and transporting unit.

Fig. 2. Closed Type Lowerator

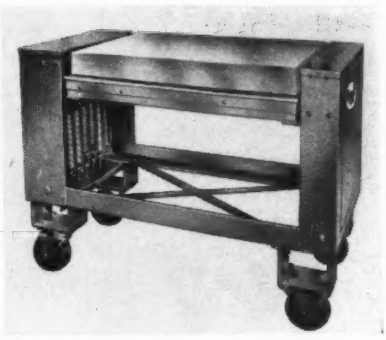


Fig. 3. Open Type Lowerator

With the closed type Lowerator, shown in Fig. 2, parts can be placed in tote boxes or material can be placed directly on the supporting platform. The open type unit, shown in Fig. 3, is adapted for handling long material or over-size tote boxes. 73

Colonial Dual-Ram Broaching Machine

A line of dual-ram broaching machines comprising nine sizes ranging from the 6-ton 42- or 54-inch stroke machine up to the 25-ton 48- or 66-inch stroke machine

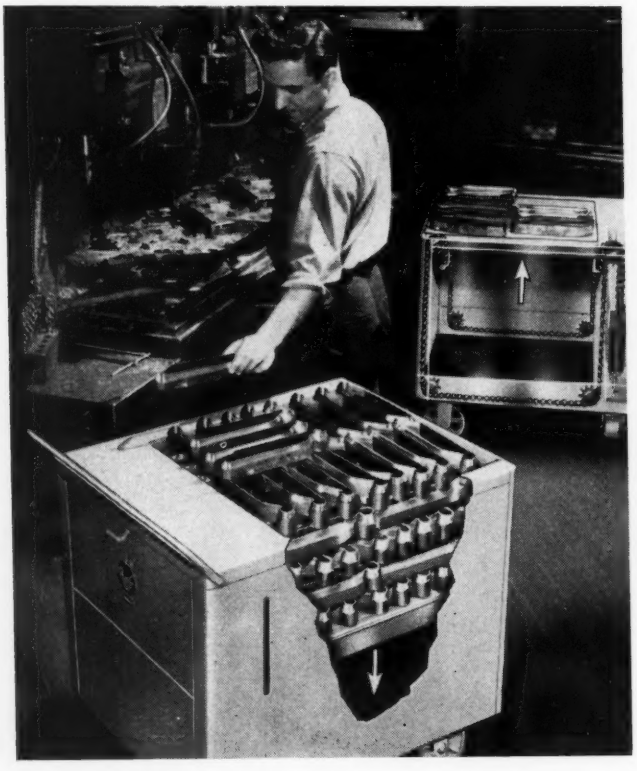
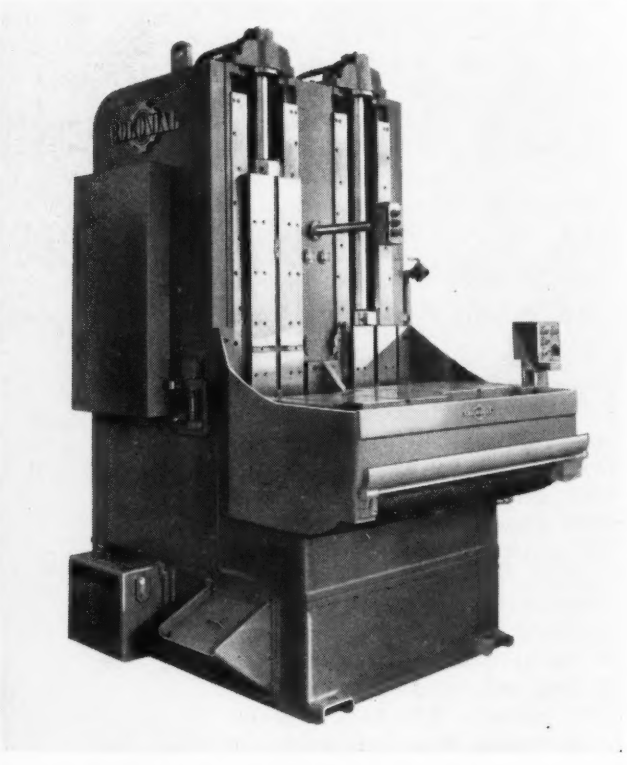


Fig. 1. Cut-away Views Showing Construction of Lowerator



Colonial 10-ton, 42-inch Stroke Dual-ram Broaching Machine

To obtain additional information on equipment described on this page, see lower part of page 238.

has been announced by the Colonial Broach Co., Box 37, Harper Station, Detroit 13, Mich. These machines are designed specifically for surface broaching. They have hydraulic and all-electric control systems of completely new design. The cycle control system virtually eliminates idle machine time during reloading, and the forward-and-reverse jog cycle simplifies setting up.

The all-electric cycling control permits the machine to be set for automatic continuous-cycle operation; single-cycle or semi-automatic-cycle operation with preset control (the machine continuing into the next cycle without stopping if a button is pushed before the first cycle has been completed); and forward- or reverse-jog cycle, with ram and platen movements interlocked to prevent accidental damage to broach or part.

A separate hydraulic system provides metered lubrication once each cycle for all bearing surfaces. The coolant flow can be regulated through a separate motorized pump. 74

Colton Preforming and Molding Press

A 55-ton preforming press designed for preforming and molding plastics, powdered metals, and ceramic products has been brought out by the Arthur Colton Co., 2600 E. Jefferson Ave., Detroit 7, Mich. This press is capable of producing as many as fifty preforms a minute. It is designed primarily for making round and odd shapes, either plain or with cored holes of any depth up to 3 inches and a diameter of 3 1/2 inches. Provision is made for accommodating dies up to 6 inches in diameter and 3 1/4 inches thick. All moving parts are enclosed, and the conical hopper has a mounting designed for quick removal from the press.

The preforming press is driven by a 7 1/2-H.P. motor through a variable-speed unit that provides the high speeds for small work or the slower speeds for larger work requiring a longer time for filling the die. A lever located near the work-table operates a new type multiple-disk clutch and a brake which can be used to stop the press instantly at any part of the stroke.

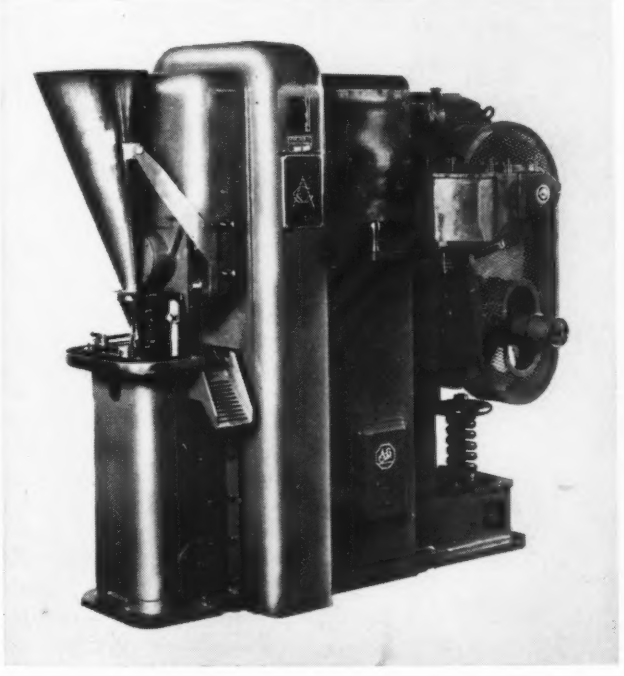
Adjustments can be made quickly for pressure, hardness, weight, and thickness and to compensate for variations in the length of the core rod. A positive-action overload release prevents damage to the press when maximum pressure is exceeded. 75

Thomson "Synchro-Matic" Flash-Butt Welder

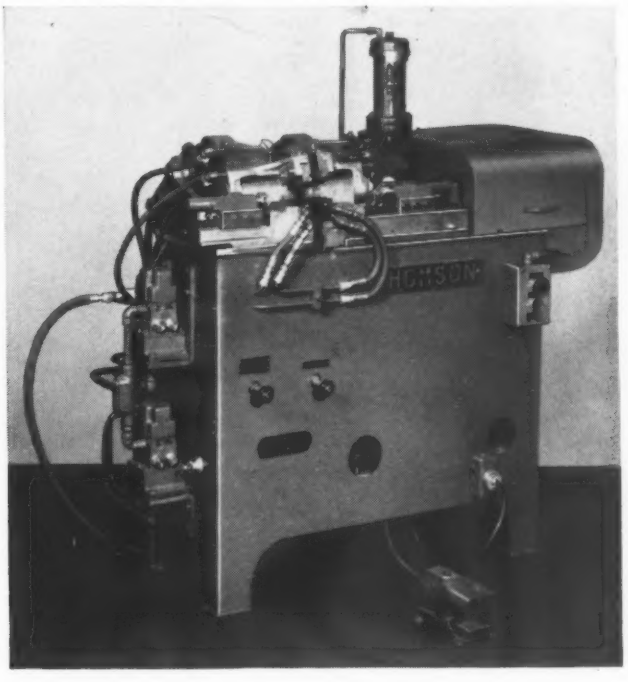
A new "Synchro-Matic" flash welder which provides automatic control of flashing and upset, with the entire welding sequence precisely synchronized and reduced to a simple push-button process, has been announced by the Thomson Electric Welder Co., Lynn, Mass. The machine is extremely simple to operate, being provided with settings and calibrated scales for controlling upset and flash-off distances and welding time. Values recommended or known to produce good welds are used in setting up the machine.

After the work is clamped in place, the welding operation is initiated either by a push-button or a foot-switch. Flashing takes place during relatively slow, but accurate and smooth, acceleration. Upset occurs at the most favorable moment just as an additional acceleration of the moving platen produces the actual weld.

This welder is designed to produce sound welds in mild or alloy steels and will also produce good welds in bronze, brass, and aluminum, and magnesium alloys. Combinations of metals normally considered impracticable to weld, such as copper to copper or copper to aluminum, can be welded with ease. 76



Preforming and Molding Press Built by the Arthur Colton Co.



"Synchro-Matic" Flash-Butt Welder Made by Thomson Electric Welder Co.

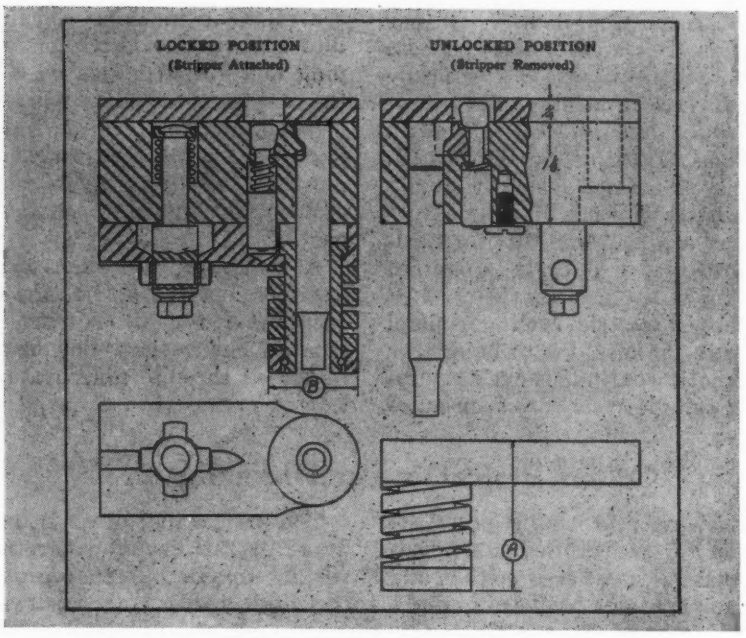
To obtain additional information on equipment described on this page, see lower part of page 238.

Clausing Lathe with Tapered Nose-Key Spindle

The Clausing Mfg. Co., 243 Richmond Ave., Ottumwa, Iowa, has announced the addition of a Series 200 to its line of precision lathes. Both headstock and gear-box of the new lathe are enclosed and the gears run in oil. The forged and hardened ASA-L-00 size spindle is ground while rotating on its own Timken tapered roller bearings The lathe has an enclosed motor drive, which provides infinitely variable spindle speeds. It is provided with back-gears and double driving belts that are easily and quickly removed.

Other features include quick-change enclosed type gear-box controls and single-lever apron longitudinal and cross feed control. The Series 200 lathe has a 1-inch collet capacity, 1 3/8-inch bore through the spindle, 12 3/4-inch swing over the bed, and 7 5/8-inch swing over the carriage. Vee and flat ways are ground to close limits of parallelism. 77

Lathe with Enclosed Headstock and Gear-box Brought out by the Clausing Mfg. Co.



Combination Punch and Stripper Unit Brought out by the Parsons Punch Co.

Parsons Combination Punch and Stripper Units

The Parsons Punch Co., P.O. Box 257, Pontiac, Mich., has added several new units to its line of punches and die accessories. The retainer-stripper unit, shown in the illustration in the locked position with the stripper attached and in the unlocked position with the stripper removed, is made in four punch sizes covering a pressure range of 160 to 675 pounds, and a travel range of 3/16 to 1/4 inch. The range of dimension *A* is from 1 21/32 to 1 29/32 inches and of diameter *B* from 1 inch to 1 3/8 inches. Group punch retainers with quickly detachable strippers are another recent addition to the company's line. 78

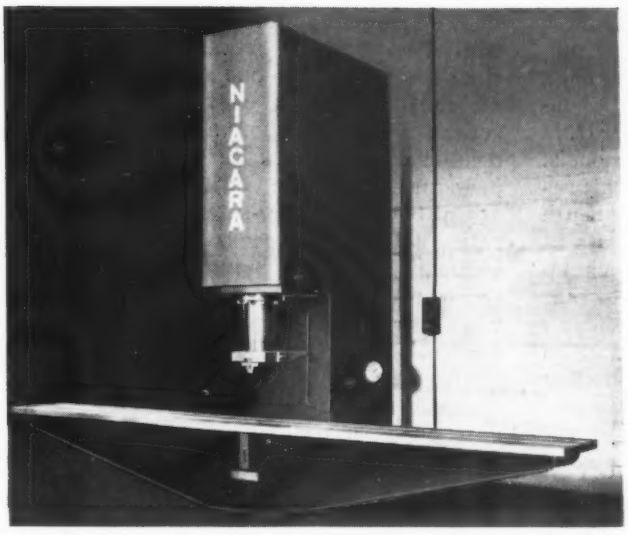
Standard Solid Carbide Cylinders

A standardized line of solid carbide cylinders, both ground and unground, has been announced by Carboloy Company, Inc., 11147 E. Eight Mile Ave., Detroit 32, Mich. The line is comprised of 115 sizes. These wear-resistant Carboloy cylinders are adapted for use as burnisher rolls, knurled roll pins, locating devices, and plunger ends. The cylinders can also be used as round bits for insert tools employed for semi-finish and finish facing, straddle-facing, and multiple turning of metals and many non-metallic materials. They range in diameter from 3/32 to 1/2 inch.....79

To obtain additional information on equipment described on this page, see lower part of page 238.

Niagara Multiple-Purpose Hydraulic Press

Straightening, forming, broaching, forging, and assembling operations can be performed on a new hydraulic metal-working press announced by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y. The "Hydro-Touch Control" of this press permits the approach speed, applied pressure, and return speed of the ram to be governed by the movement of one lever.



Niagara Multiple-purpose Hydraulic Press

Practically no pressure is exerted by the punch when it first touches the work. Further movement of the control lever causes pressure to be applied in proportion to the amount the lever is moved. Thus any pressure up to the maximum capacity of the press is easily obtained. Releasing the lever at any point stops the ram and causes the lever to automatically return to the neutral position. The bed of the press is 30 by 240 inches. The maximum pressure of 135 tons can be exerted at any point. 80

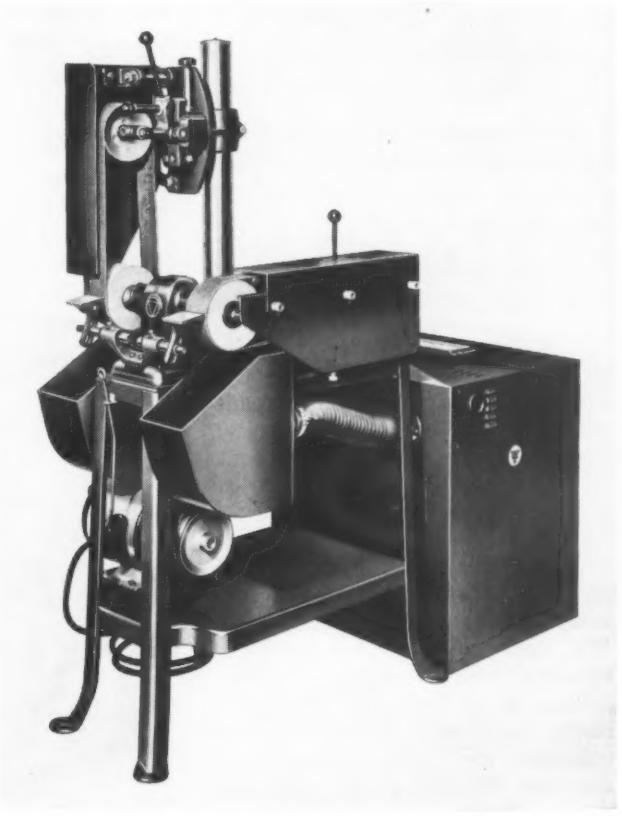
Sheffield Automatic "Airlectric" Machine

An unusual automatic "Airlectric" gaging and classifying machine has been developed by the Sheffield Corporation, Dayton 1, Ohio. Two identical mechanisms for gaging, classifying, and stamping refrigerating unit muffle boxes with twenty-one classifications, varying by 0.0003 inch each, are incorporated in the machine. One spindle is loaded and unloaded by the operator while the other mechanism is going through the gaging cycle. Should the muffle-box bore be beyond tolerance limits, lights indicate which dimension is off and the piece is not stamped. 81

Delta-Milwaukee Abrasive Belt Grinding, Polishing, and Deburring Machine

A Type H grinding, polishing, and deburring machine, designed to perform a wide variety of operations formerly handled on a heavier and more expensive machine, has been developed by the Delta Mfg. Division, Rockwell

Automatic Gaging, Classifying, and Stamping Machine

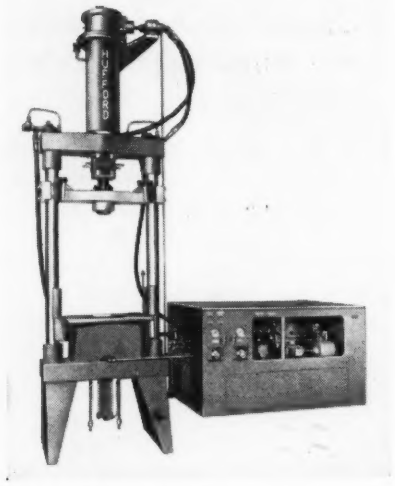


Abrasive-belt Grinding, Polishing, and Deburring Machine

To obtain additional information on equipment described on this page, see lower part of page 238.

Mfg. Co., 600 E. Vienna Ave., Milwaukee 1, Wis. The new machine uses coated abrasive belts instead of wheels, and can be employed as a portable unit. It is available in four different models.

One of the outstanding features of this machine is that it can use two different quality grit belts at the same time, which speeds up the production of small parts that require more than one finishing operation. The machine can also be easily converted into a buffing machine. Two driving belts can be run through the bottom of the arbor head for use on a welded steel stand, or they can be run through the back of the arbor head for use on other benches...82



Hufford Hydraulic Press Designed to Produce Threaded Plastic Parts

"Rotating Tool" Hydraulic Press for Forming Threaded Plastic Parts

A "rotating tool" hydraulic press designed primarily for the hot-pressing of all sizes of threaded and plain porcelain electrical insulators has been brought out by the Hufford Machine Works, Inc., Redondo Beach, Calif. This press is also applicable to general pressing and forming operations on plastic materials where a combination of controlled tool rotation and pre-regulated pressing tonnage is advantageous.

The press provides for two basic operations: First, where a rotating tool must press and simultaneously descend and ascend to form an accurate thread; and, second, where the forming operation is performed by forcing work against a fixed, rotating tool. Two separate actuating circuits are employed—one as a fluid motor for rotation of the lead-screw, and the other as a hydraulic ram for work location and pressing. Accurate adjustments are provided to pre-set rotation rates, lead-screw speeds and direction of rotation, point of lead-screw reversal, work lift stroke, work lift speed, and pressing tonnage.

The press can be operated as a manually controlled single-cycle unit or as a continuous cycling unit for delivering any desired pattern of interlocked motions. Interlocks and assured repetition of any desired cycle are features obtained with the Hufford "mechanical brain" timing device, which employs cam-driven hydraulic valves that positively control the sequence of ram and tool motions. 83

Sheffield Spline-Burring Machine

The fly-tool spline-burring machine shown in Fig. 1 is a recent addition to the line of machine tools manufactured by the Sheffield Corporation, Dayton, Ohio. This machine is especially designed to burr involute or straight splines where the adjacent shaft diameter approaches the root diameter of the splines.

In operation, the part is placed in a receiver and the hand- or air-operated clamping device employed to force the part into a rotating spline collar and forward

Fig. 1. Sheffield Spline-burring Machine

against a positive hinged stop or locator, as shown in Fig. 2. The movements of part and cutter are so synchronized that the fly tool passes through the spline tooth spaces, chamfering the sides of each tooth to an angle of 30 to 40 degrees. In many cases, splines can be chamfered in the root as well as on the sides, the relative positions of the fly tool and work being as shown in Fig. 3. When the part has made a complete revolution and all splines are burred, the operator is signaled by a light so that he can unclamp the part which is then ejected by a spring collar. An average ten-tooth spline can be burred in approximately three seconds, the floor-to-floor time averaging ten seconds. 84

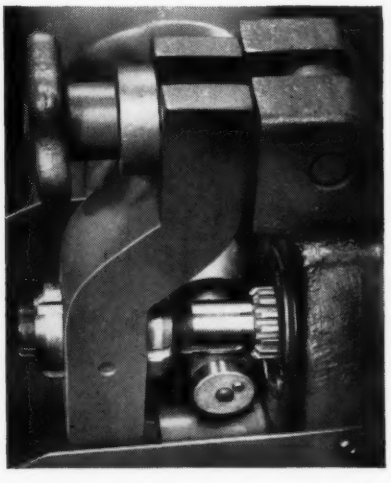


Fig. 2. Close-up View of Hinged End Locator and Clamp of Spline-burring Machine Shown in Fig. 1

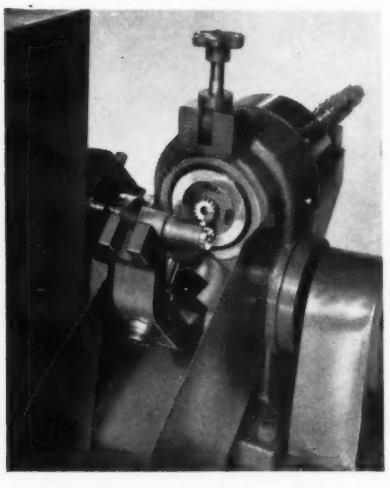


Fig. 3. Close-up View of Cutter-bar with Fly Tool Engaging Work Held in Chuck of Burring Machine

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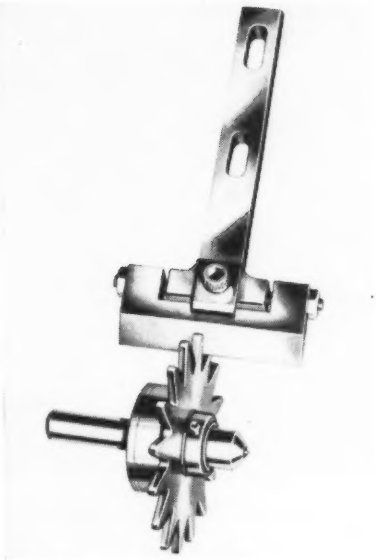


Fig. 1. "Diamond-Miser" Grinding Wheel Truing Device Arranged for Metered Indexing of the Diamond by Automatic Rotation

"Diamond-Miser" Wheel-Truing Tool

A wheel-truing tool known as the "Diamond-Miser" has been added to the line of equipment built by the Wheel Trueing Tool Co., 3200 W. Davison St., Detroit 6, Mich. The "Diamond-Miser" is a special diamond tool holder that can be installed on a grinding machine in a position which assures that the diamond will be presented to the wheel at the correct angle for efficient cutting. Following each pass across the face of the grinding wheel, the metered indexing mechanism automatically rotates the tool a predetermined number of degrees, assuring that no facet is ever reused in identical form, but is turned just enough to present a new cutting edge to the wheel. A metered indexing mechanism for manual turning is also available for installation where automatic truing is not desired.

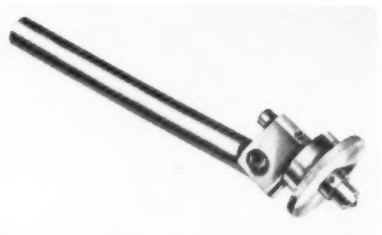


Fig. 2. "Diamond-Miser" Arranged for Indexing by Manual Rotation

Fig. 1 shows the arrangement for metered indexing by automatic rotation, while Fig. 2 shows the design developed for metered indexing by manual rotation.....85

Applicator for Dry Powder Lubricant

A handy gun type applicator consisting of a nozzle and bulb for blowing "Grafize," a dry powder lubricant, into working mechanisms has been brought out by Reardon Products, 2105 S. Adams St., Peoria 2, Ill. Simply removing the nozzle, compressing the bulb and inserting it in the can of "Grafize," and releasing the pressure causes the powder lubricant to be drawn into the gun. After the nozzle is replaced, the powder lubricant can be ejected to lubricate any desired spot by applying light pressure on the bulb. "Grafize" is not an oil and has no oil derivatives. It does not freeze at any temperature ordinarily encountered and will withstand heat up to 6300 degrees. Both the "Grafize" and the applicator are available from Reardon Products. 86

Elastic Stop-Nut for High-Temperature Applications

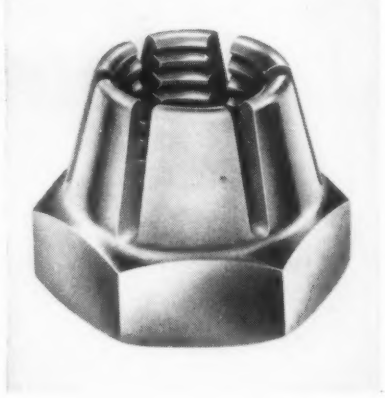
The Elastic Stop Nut Corporation of America, 2330 Vauxhall Rd., Union, N. J., has announced a new stop-nut designed for fastener applications where temperature ranges from —65 degrees F. to + 1200 degrees F. are encountered. These new fasteners are all self-locking and provide permanent protection against vibration, impact, and stress reversal in fully seated and positioned settings. Sizes range from 10–32 up to 3/8–24..87

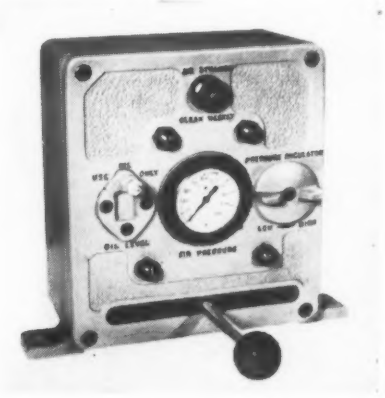
Respirator for Protection Against Dust

Inexpensive new respirator announced by the American Optical Co., Southbridge, Mass. Effective in protecting workers against light concentrations of dust encountered in woodworking plants, cement mills, coal yards, grain elevators, and plants where workmen are exposed to pneumoconiosis- and silicosis-producing dusts. The streamline design allows unobstructed front and side vision. The filter is lightweight and easily replaced. 88

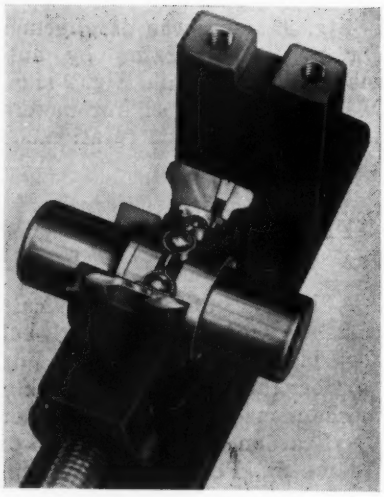
Lehigh-Marton Four-Way Air-Valve Unit

Four-way cabinet type air-valve unit suitable for use on standard machine tools on which no recess has been provided for instruments or where an enclosed valve of neat appearance is required to harmonize with new machines of streamline design. The valve has a 200 pounds per square inch gage and a regulator for adjusting the pressure from 15 to 200 pounds per square inch. Manufactured by Lehigh Foundries, Inc., Easton, Pa..89





To obtain additional information on equipment described on this page, see lower part of page 238.



Fafnir Take-Up Units for Ball Bearings

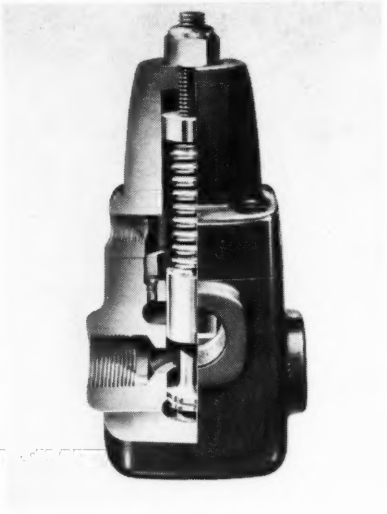
One of a new series of take-up units recently added to the line of "Mechani-Seal" ball bearing power transmission units, manufactured by the Fafnir Bearing Co., New Britain, Conn., especially adaptable for conveyor construction, shaft adjustment, and belt-tightening devices. Shaft sizes range from 3/4 inch to 2 7/16 inches. These units incorporate prelubricated, self-aligning Fafnir wide inner ring ball type bearings with self-locking collars and frictionless "Mechani-Seals." 90

Hammond Air-Actuated Back-Stand

Back-stand (designated Model 3-A) for heavy production grinding or polishing with abrasive belts. It is equipped with air-actuated cylinder which automatically maintains correct belt tension, compensating quickly for any stretching of the belt. Can be attached to maintain correct tension for any kind of material or type of work. Plain stainless-steel idler pulley 12 inches in diameter with a 7-inch face runs on sealed ball bearings. Brought out by Hammond Machinery Builders, Inc., Department GP-14, Kalamazoo 54F, Mich. 91

Chatter-Free Relief Valve

Chatter-free performance is the outstanding characteristic of a new hydraulic relief valve developed by the Gerotor May Corporation, P. O. Box 86, Baltimore 3, Md. This valve is designed to protect hydraulic systems against overloads of pressure. In addition to the dash-pot designed to stop chatter, the valve embodies other basic improvements, including pressure ports which permit an in-line piping arrangement; valve springs in two sizes, for 50-300 and 50-1500 pounds per square inch; a spring guide, available with "O" ring seal when the valve incorporates a handwheel adjustment; a one-diameter bore for the most accurate plunger fitting; and a self-sealing lock-nut which eliminates lost valve caps. 92

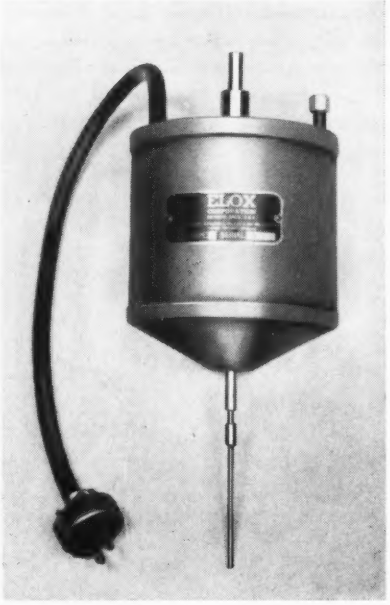


Multiple Refill-Type Oil Filter

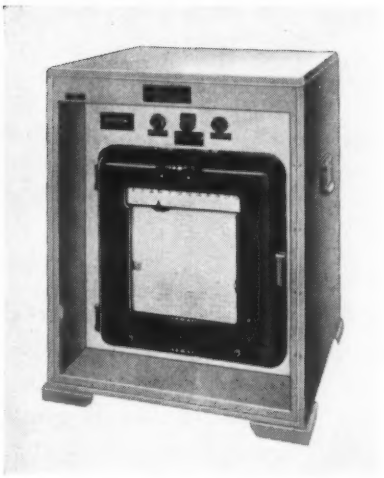
Multiple refill-type oil purifier employing seven filtering units. Produced by the Honan-Crane Corporation, Lebanon, Ind., a subsidiary of Houdaille-Hershey. Has a maximum capacity exceeding 2100 gallons per hour of 50 seconds' viscosity, color-clear oil on continuous circulation. Each filtering unit consists of a perforated steel basket containing a cloth bag with a capacity for 104 pounds of the special filtering material known as "Cranite." 93

Electrical Disintegrator for Removing Broken Tools

Light-weight, low-priced portable disintegrator for removing broken tools. Can always be kept on the tool-crib shelf, ready for use, and can be set into the chuck of a drill press. This Model X electrical disintegrator can be used for removing studs, pins, and all kinds of broken tools, including taps and drills. It is only necessary for the user to supply a source of city water, and electricity at the lighting voltage. Brought out by the Elox Corporation, Clawson, Mich..94



To obtain additional information on equipment described on this page, see lower part of page 238.

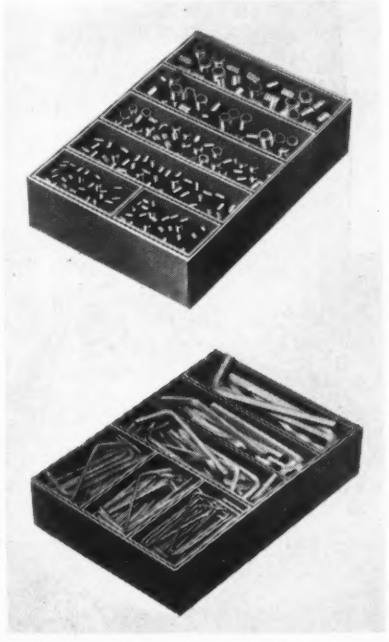


Portable Electric Pyrometer

Portable electric pyrometer recorder and controller, so arranged that six points of heat up to 2200 degrees F. can be easily recorded or controlled. This fast-acting unit, recently announced by Electric Arc, Inc., 152-162 Jelliff Ave., Newark 8, N. J., is arranged for simple electric off-on control. It can be used for semi-automatic or completely automatic control for heat cycles. The instrument is 30 inches high, 24 inches wide, 22 inches deep, and weighs 100 pounds. 95

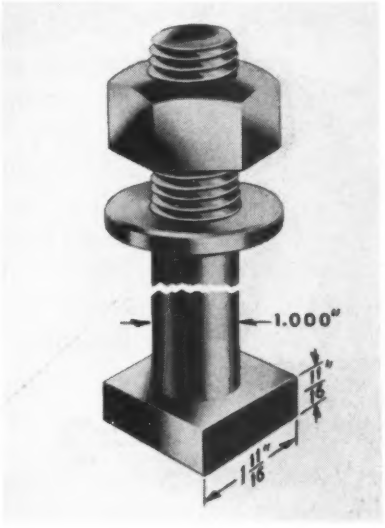
Ground-Thread Socket Set-Screws and "Hex" Keys

Assortments of socket set-screws and engineered "hex" keys brought out for distribution among dealers by the Parker-Kalon Corporation, 200 Varick St., New York 14, N. Y. The set-screws are centerless thread ground, and are free from nicks, burrs, and hardening scale. Assortment consists of 225 pieces ranging in size from No. 6 up to 3/8 inch. The assortment of "hex"" keys consists of 125 keys to fit assortment of set-screws described. 96



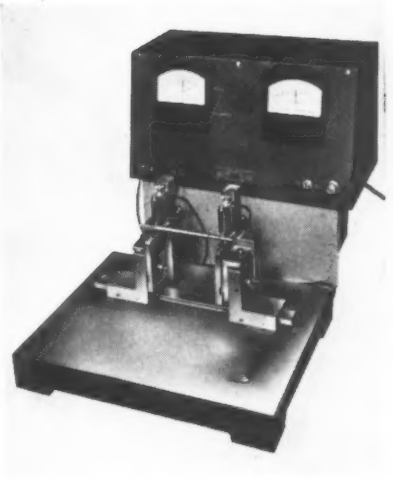
Boyar-Schultz Special Machine Bolt

Precision-made, alloy-steel, heat-treated special machine bolt made to conform in dimensions and strength to specifications adopted by leading manufacturers of large presses. These bolts are accurately threaded to a close fit, and are given a rust-resisting finish. Nuts of special alloy steel are accurately threaded to match the bolt threads. The heat-treated washers are chamfered, and have both sides ground for parallelism. Made by the Boyar-Schultz Corporation, 2110 Walnut St., Chicago 12, Ill. . 97



Graham-Mintel Two-Channel Inspection Gage

Two-channel inspection gage developed by Graham-Mintel Instrument Co., 2443 Prospect Ave., Cleveland 15, Ohio, for fast, simultaneous, and accurate inspection of two diameters. Induction type measuring heads operate without friction and have a fine adjustment range of 0.025 inch to facilitate quick setting up for various sizes of work and for making correction for wear. Each head has independent adjustment. Zero setting is accomplished by the use of masters. An amplifier unit operates on 110-volt, 60-cycle current and has voltage regulation over a range of 95 to 125 volts. Two continuous linear scales are divided into 0.0005 inch or 0.00005 inch, having approximately 5/16-inch spacing per thousandth or ten-thousandths inch, which allows fast reading to ten-millionths inch. 98



Oilgear Two-Column Vertical Broaching, Swaging, and Straightening Press

Two-column 25-ton vertical broaching, swaging, and straightening press brought out by the Oilgear Co., 1340 W. Bruce St., Milwaukee 4, Wis., for finishing a wide variety of agricultural implements and tractor parts to size. This press is equipped with

To obtain additional information on equipment described on this page, see lower part of page 238.

For the First Time!

Electronic on

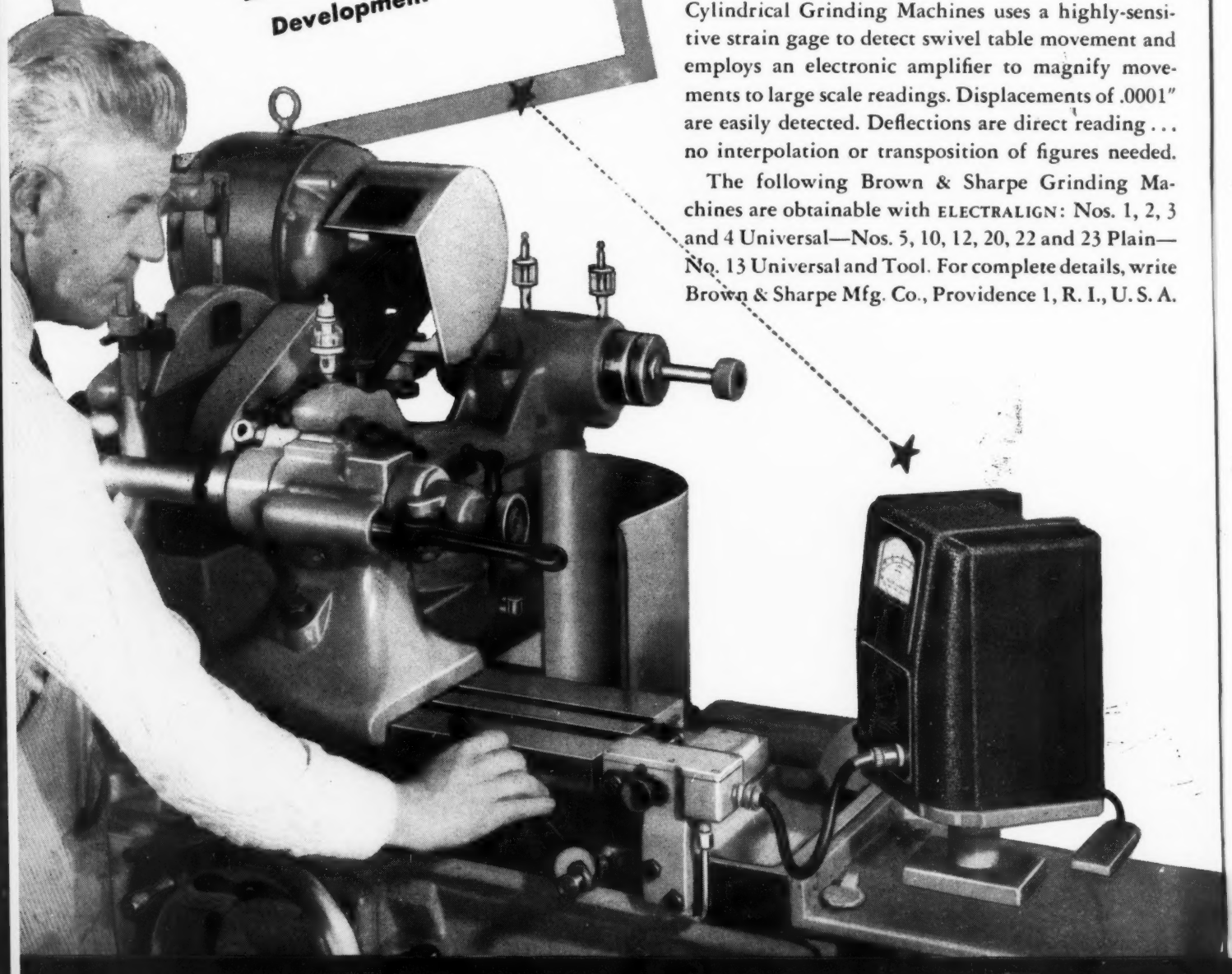
ELECTRALIGN

Exclusive New Brown & Sharpe Development

Here is a unique aid that permits grinding machine operators to accurately align a swivel table for straight or tapered work after only *one* preliminary grind. ELECTRALIGN, designed to transfer operator's skill to a function of the machine, eliminates costly time-consuming, cut-and-try operations. It does much to eliminate spoiled work, particularly where only .002" to .003" is left for finish grinding.

This exclusive arrangement for Brown & Sharpe Cylindrical Grinding Machines uses a highly-sensitive strain gage to detect swivel table movement and employs an electronic amplifier to magnify movements to large scale readings. Displacements of .0001" are easily detected. Deflections are direct reading . . . no interpolation or transposition of figures needed.

The following Brown & Sharpe Grinding Machines are obtainable with ELECTRALIGN: Nos. 1, 2, 3 and 4 Universal—Nos. 5, 10, 12, 20, 22 and 23 Plain—No. 13 Universal and Tool. For complete details, write Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.



BROWN &

Alignment of Swivel Table Grinding Machines

ACCURATE SETTING EASILY MADE

The extreme simplicity and reliability in operation of the ELECTRALIGN makes it very practical for shop use. Corrections in swivel table alignment may be made simply and precisely. No need of regrinding several test pieces to obtain proper adjustment.

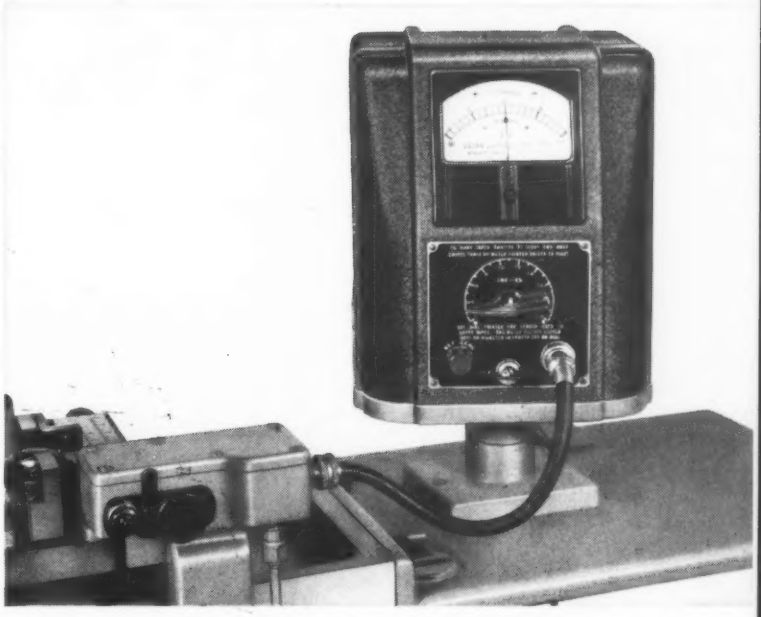
SET-UP TIME SHARPLY REDUCED

After ELECTRALIGN amplifier pointer has been set to the ten-thousandths desired to swing the work, the operator makes a single, positive correction by moving the table, through its regular adjusting mechanism, until the pointer reads zero. It's done in an instant! This correction can be made during the grinding operation.

EASIER OPERATION FASTER PRODUCTION

On long work ground to close limits, even a slight taper may represent a large part of the allowable tolerance. On this type of work, ELECTRALIGN makes setups easier and more positive . . . makes faster production possible . . . and reduces risk of spoilage. Tapers, too, can be set directly after one preliminary grind . . . and precise settings maintained.

OTHER PRACTICAL ADVANTAGES — ***ELECTRALIGN*** may be supplemented by the Electralign-Comparator Selector when external or internal measurements employing a comparator are made in conjunction with setting the table for alignment. This equipment eliminates differences in measurement due to human "touch or feel" and a wide choice of comparators is possible.

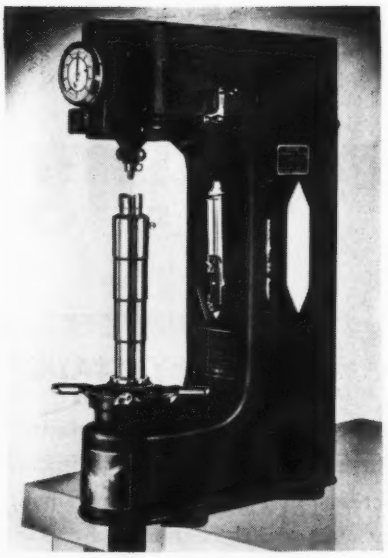


Conveniently located Electralign Amplifier magnifies small angular swivel table movements to large scale readings.

Operator using Electralign-Comparator Selector with a special gage to check measurement of straight work. A wide variety of comparators may be adapted for use with this equipment.

SHARPE B·S

a hand-lever operated, spring-returned broach-receiver basket. It also has a hand-lever and foot-pedal control to an Oilgear two-way variable-delivery pump which is directly connected to a 25-H.P. electric motor. Maximum tonnage can be varied from 5 to 25 tons through an adjustable relief valve. General specifications are: Stroke, 24 inches; daylight height, 30 inches; distance between the columns, 24 inches; distance front to back, 24 inches; hole in table, 9 inches in diameter; table height, 24 inches; ram speed on downward stroke, variable up to 270 inches per minute; ram speed on upward stroke, variable up to 540 inches per minute; and net weight, 6500 pounds. 99

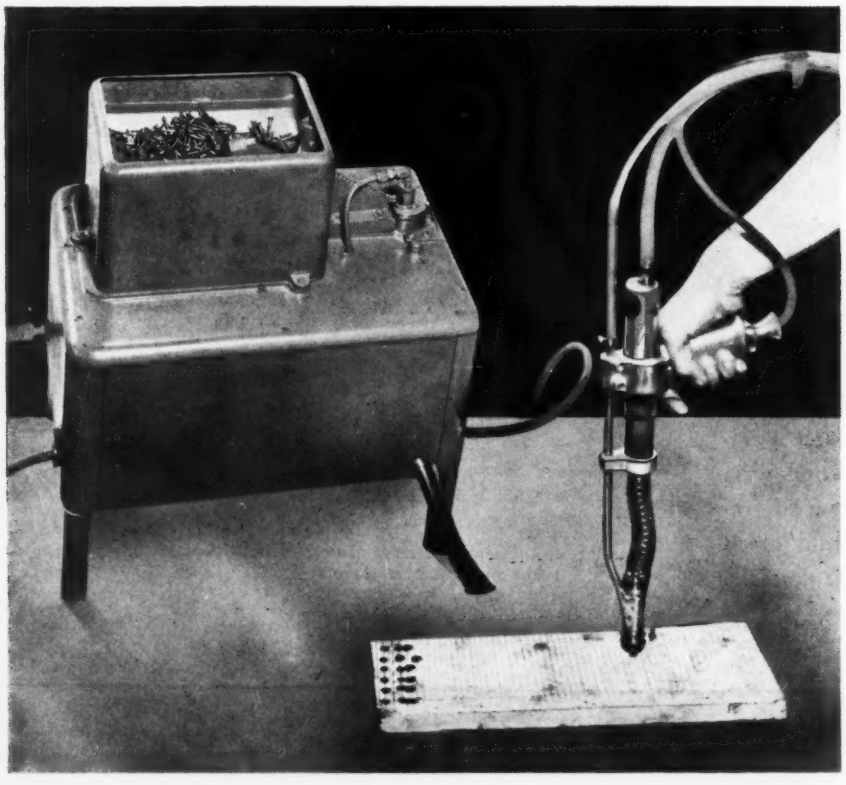


Thriftmaster Adjustable Drill Head

New universal-joint type adjustable drill head designed for close center-to-center drilling. Minimum center distance adjustment on any drilling pattern within a 6 5/8-inch circle is 11/16 inch. The spindles are regularly furnished with collet chucks, and collets can be supplied for 1/32- to 1/4-inch drills. Spindles are also available with No. 1 Morse taper sockets. The gear housing is sealed against the entrance of grit or abrasives and the leakage of lubricants. This Model U620B drill head is available with any desired number of spindles from two to six. It operates on a 1 to 1 ratio, is designed for right-hand rotation of the drill press spindle, and is adaptable to any drill press. The weight of the six-spindle drill head is approximately 21 pounds. Announced by the Thriftmaster Products Corporation, Lancaster, Pa. 100

Clark Hardness Tester

Improved Clark hardness tester with cast-aluminum body that is 65 to 85 pounds lighter than preceding models. Used for Rockwell testing of hard and soft steel, brass, aluminum, cast iron, copper, and other metals and alloys, as well as plastics. Outstanding features include a frictionless spindle, which is said to assure a correct minor load; positive tripping for a more accurate major load; and an elevating screw which is fully enclosed for protection from dust and rust. The telescopic elevating screw cover can be easily lowered by loosening a lock-screw. Available in three standard models with 8-, 12-, and 16-inch vertical capacities from Clark Instrument, Inc., 10200 Ford Road, Dearborn, Mich. 101

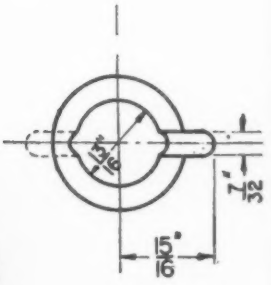


Reed-Prentice Pneumatic Automatic Screwdriver

An air-operated automatic screwdriver developed to feed screws, one at a time, from hopper to driver. One movement of the trigger by the operator causes the driver to automatically grip the screw after it has been pneumatically delivered through a tube from the hopper, while a second movement of the trigger releases air pressure to the screwdriver motor for driving the screw. An air pressure of 90 pounds is sufficient for operating both the feed mechanism and the driver. This pressure will feed screws to the driver from the hopper when it is located a maximum distance of 50 feet away. The model shown will handle slotted or recessed head screws from No. 4 to No. 10, up to 1 1/4 inches long, and models can be provided to handle any size or type of wood, metal self-tapping or machine screws. Brought out by Reed-Prentice Corporation, Department 27, 677 Cambridge St., Worcester 4, Mass. 102

To obtain additional information on equipment described on this page, see lower part of page 238.

IT'S A full-time SHAPER...



PHOTOS—COURTESY THE OHIO KNIFE CO., CINCINNATI, OHIO

Working two shifts, full time, this Cincinnati Shaper notches fourteen plow-bolt holes in these shear knives every five minutes.

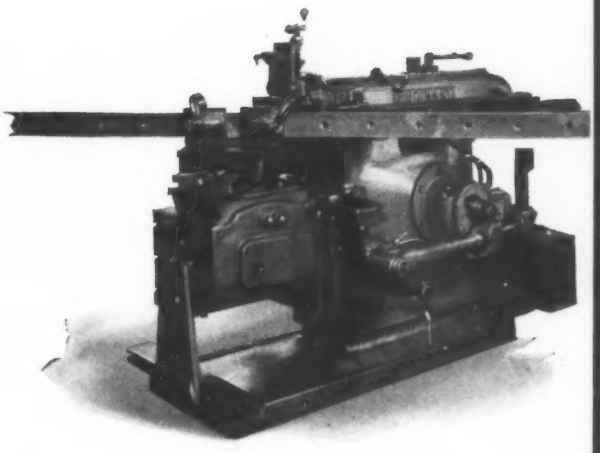
PRODUCTION

Shapers at The Ohio Knife Company are used strictly as manufacturing tools, for mitering, contour cutting, slotting, corrugating and beveling knife blades.

The setups for all these operations are simple, rapid and inexpensive—and a low manufacturing cost results.

COSTS

Write for Shaper Catalog N-3. It will help you determine the size and type of Cincinnati Shaper you need.



Knives are high carbon, high chrome steel. Cutting tool is high-speed steel. Shaper operates at 119 strokes per minute.

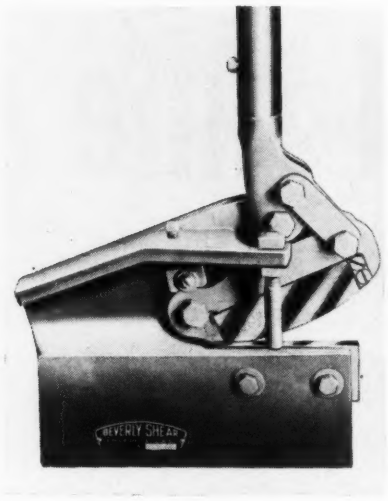
THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

Dake Hydraulic Press

A 125-ton hydraulic press recently added to the line manufactured by the Dake Engine Co., 604 Seventh St., Grand Haven, Mich. Available either in hand-, air-, or electrically-operated models. Developed primarily for use in tool and die shops, automotive repair shops, general machine shops, heat-treating plants, welding shops, and foundries. Has an 8-inch stroke with an additional 8-inch adjustment available through an auxiliary screw type ram. Air-operated models are built to operate on either 90- or 145-pound per square inch air pressure lines. Special safety features include a valve to prevent over-extending the ram, and valves on air and electric models to prevent overloading. Width between press uprights, 48 inches; between table channels, 12 1/4 inches. . . 103



Beverly Slitting Shear

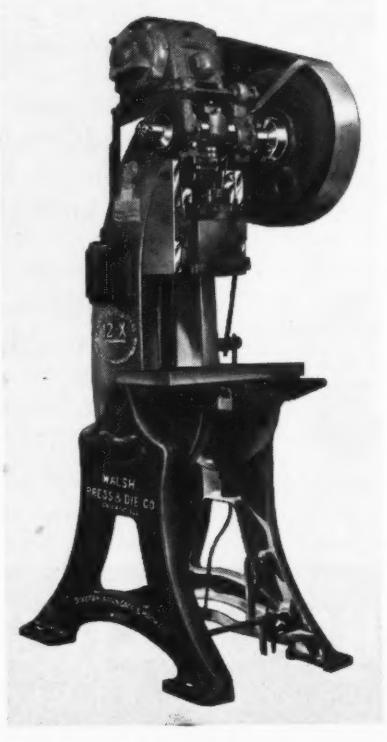
Portable slitting shear with capacity for slitting 1/8-inch mild steel and 10-gage stainless-steel sheets. Introduced by the Beverly Shear Mfg. Co., 3009 W. 110th Place, Chicago 43, Ill. An adjustable shoe provides additional support at the toe of the upper blade-holder, giving increased strength and cutting efficiency. The heavy frame provides the rigidity and strength required to assure sharp, clean cutting, and prevents any side play or movement of the blades when cutting heavy-gage steel. Easy operation is assured by the powerful toggle action of the upper blade-holder. Shear blades are interchangeable and adjustable. Tempered and drawn tool-steel blades or high-carbon high-chromium blades are furnished. 104

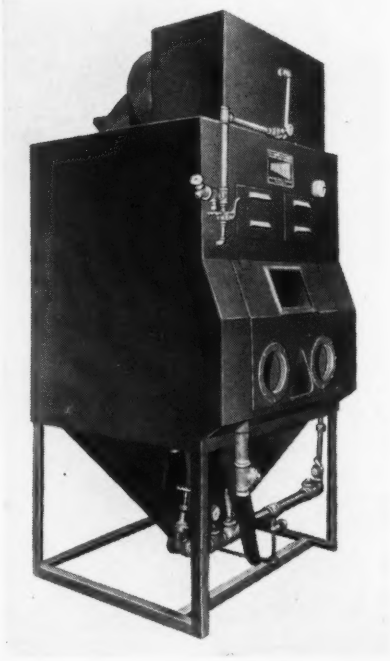
Hawke Reel Stand

Reel stand with all-welded steel-frame cradle and reel designed for practically all coiled materials. Provides quick loading features combined with smooth feeding operation, which eliminate over-run or pull-back of stock. Core size can be quickly adjusted for inside diameters of 3 1/2 to 16 inches. Standard model accommodates coils 3 inches wide and up to 28 inches in diameter. Announced by the Hawke Mfg. Co., 111 S. Glendale Ave., Glendale, Calif. . 106

Walsh Deep-Throat Press

New Model 12X deep-throat open-back flywheel type punch press recently added to the line manufac-





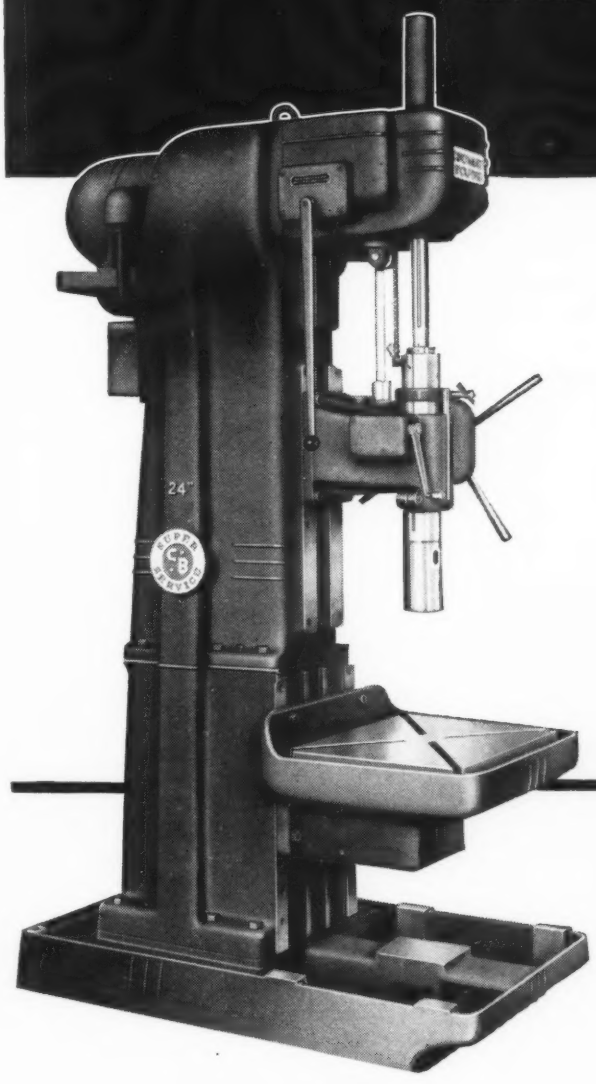
"Jet Blast" Metal Cleaning and Finishing Machine

Armstrong Chemical and Machine Co., Painesville, Ohio, has announced a new "Jet Blast" machine for wet abrasive-blast cleaning and finishing of metal surfaces. The machine removes rust, scale, and undesirable metal particles such as feather-edges on sharpened tools by projecting fine abrasive suspended in water against the surface to be cleaned. The large permissible variation in abrasive size —60 to 1250 mesh—makes it commercially possible to produce finishes as low as 2 to 3 micro-inches r.m.s. The method is said to produce a matte finish with practically no removal of metal. Standard models are made in 30- by 30- by 77-inch and 48- by 42- by 108-inch sizes with one to eight blast nozzles and an exhaust blower directly connected to a one-H.P. driving motor. 105

To obtain additional information on equipment described on this page, see lower part of page 238.

They have the SPEED and ENDURANCE for

Automotive Production

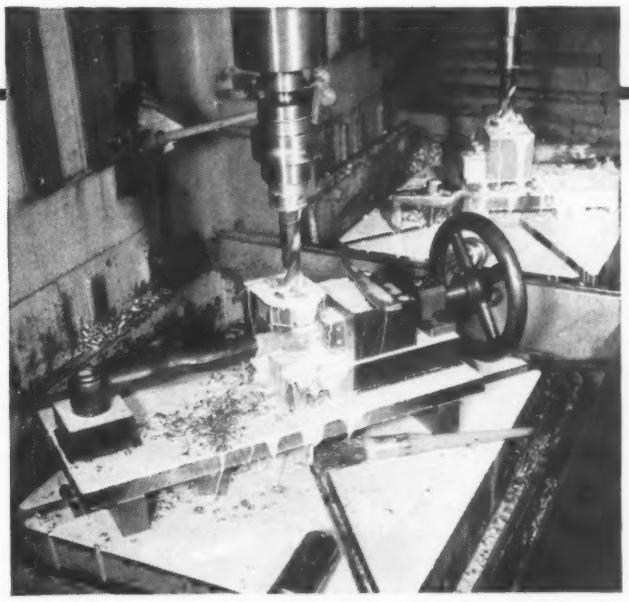


Among the factors which permit long and severe working performance of Bickford Super Service High Production Upright Drills are the direct drive motors, positive type clutch, sturdy gearing, integral keying of all spline shafts, and complete protective enclosure of all mechanism.

Speeds and feeds are easily obtained by the operator. Control levers are at operator's finger tips, and bring rapid and easy operational control.

The close-up shows a Cincinnati Bickford Super Service Upright Drill at work in the automotive industry where production is a must.

Write for Booklet U-27—a complete description of the construction features and capacities of Cincinnati Bickford Super Service Single and Multiple Upright Drills.



Courtesy—The Kaiser-Frazer Willow Run Plant.

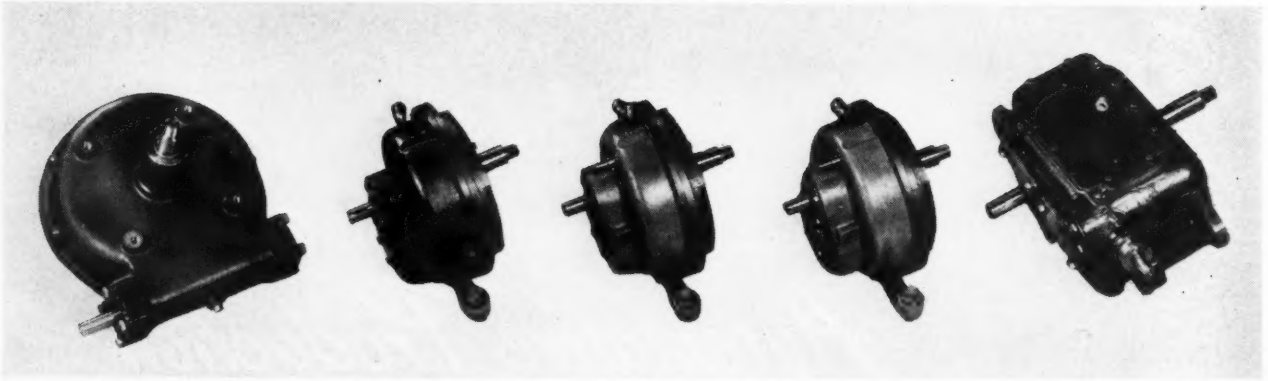
THE CINCINNATI BICKFORD TOOL CO.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Radials 7½" dia. col., 2½' arm, to 26" dia. col., 12' arm.
General purpose Uprights, 21" to 28" sizes.
Production Uprights, 21" to 28".
Jig Borers, Portable Horizontals, Spacing Table Machines.

Equal Efficiency of Every Unit Makes the Balanced Machine

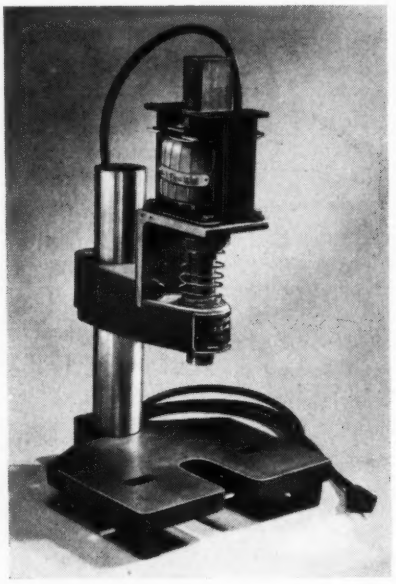
THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.



tured by the Walsh Press & Die Co., 4709 W. Kinzie St., Chicago 44, Ill. This press is suitable for die-castings and also for secondary forming operations on sheet metal as well as many other kinds of punch press work. It is available with stroke lengths of 1 1/2 to 4 inches and a shut height of 9 inches, with a throat depth of 6 inches. Furnished completely motorized or with a variable-speed motor. A two-button safety device with non-repeat attachment, as well as air ejectors, can also be furnished. 107

Automatic "Speedex" Dial Feed for Punch Presses

Automatic "Speedex" dial index feed for punch presses, brought out by de Castro & Associates, 2477 Randolph St., Huntington Park, Calif. The standard table of this dial feed is 12 inches in diameter, but larger tables are available on special order. Ample space is provided for air ejectors and automatic loading mechanisms. The die space at rear of table is 3 1/2 by 3 3/4 inches; over-all height is 3 1/2 inches. This equipment can be adapted to any ordinary punch press without altering the press and can be quickly removed or replaced. It is driven by means of an eccentric which can be assembled on the crankshaft of the press. 108



Black & Webster High-Speed "Electropunch"

High-speed punch recently added to the line of "Electropunches" manufactured by Black & Webster, Inc., 30 Pleasant St., Needham 92, Mass. This new Model BS 1 punch incorporates a high-temperature silicone-insulated coil in the ruggedly constructed solenoid, which permits it to operate continuously at more than 150 cycles or blows per minute, delivering an impact of more than a ton. It is suitable for such operations as staking, riveting, marking, wire cutting, blanking, forming, and drawing of metals, plastics, fabrics, and leathers. The punch requires less than 1 square foot of bench space, and weighs 45 pounds. 109

DoAll Gear Transmissions and Spindles

New line of gear transmissions ranging in capacity from 0.1 to 7 H.P. and having reduction ratios of 40 to 1, 17 to 1, and 4 to 1. Several are two-speed units with gear shifts for quick change of speeds. Each transmission is a self-contained unit with means for mounting in a choice of locations. Designed for continuous heavy duty. Ball and roller bearings and hardened gears are used throughout, operating in an oil bath and requiring a minimum of service. Also included in this announcement is a line of flange-mounted spindles, all equipped with anti-friction precision bearings, designed for continuous operation, and suitable for a variety of purposes ranging from light to heavy duty. Developed by the DoAll Co., Des Plaines, Ill. 110

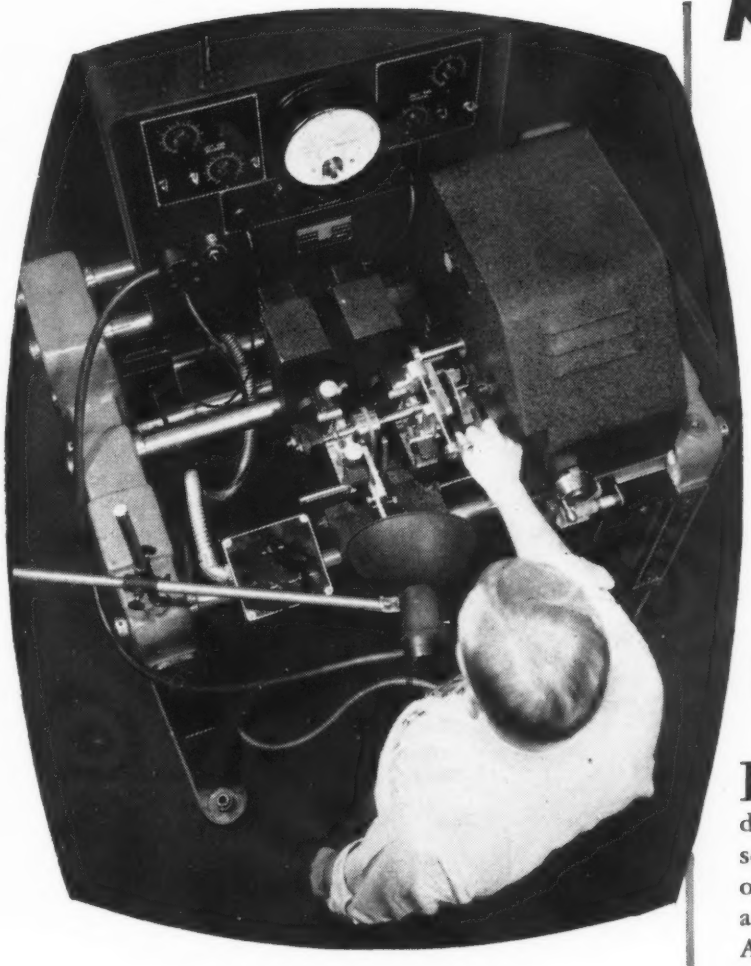
Lepel High-Frequency Heating Unit

Vacuum-tube, high-frequency heating unit adapted for heating non-ferrous as well as ferrous materials

To obtain additional information on equipment described on this page, see lower part of page 238.

1 MACHINE handles all 3 STEPS

of the complete balancing process!



1 *Locates and measures the unbalance*

2 *Corrects the unbalance*

3 *Inspects for over-all accuracy*

at the rate of 100 PIECES PER HOUR!

Balancing these fans for vacuum sweepers is now done completely on *one* machine. It takes only a few seconds to locate and measure the unbalance. Then, the operator turns the piece to the proper angle and turns a hand-wheel to correspond with the meter reading. At the press of a button, a fly-cutter removes the exact amount of metal to bring the part into balance. The part may be rechecked if desired.

The inclusion of correction equipment indicates the modern trend in balancing with Gisholt DYNETRIC Balancers. It saves handling—only one loading is required to complete all three steps.

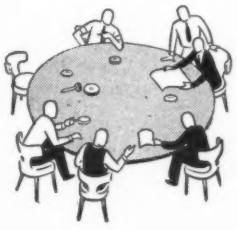
Those who are concerned with balancing of rotating parts have learned that it's wise to specify Gisholt.

DYNETRIC BALANCERS — GISHOLT — DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION. "DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

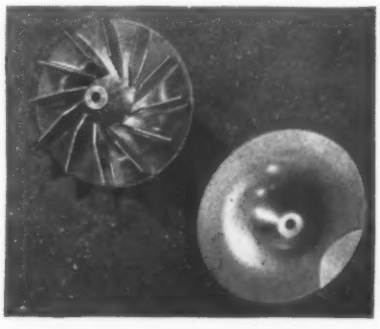
GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface finishing, and balancing of round and partly round parts. Your problems are welcomed here.

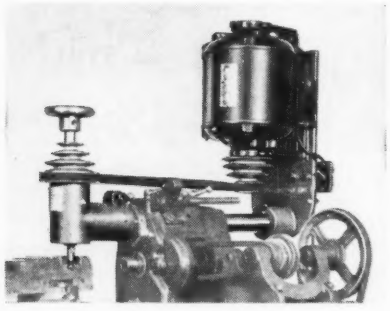


Showing front and back of fan with metal removed to correct unbalance. The entire balancing operation required an average of less than 45 seconds per piece.



TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SUPERFINISHERS • SPECIAL MACHINES

to any desired temperature. Announced by Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York, N. Y. This machine can be used for hardening, soldering, pressing, or melting. Brought out as a companion machine to the recently announced Lepel spark-gap type heating unit for those who prefer to use tube type equipment. 111

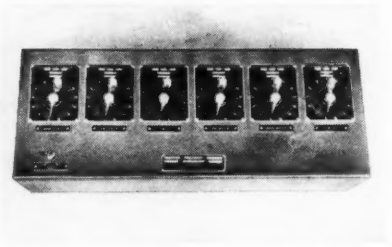


Hutchinson Vertical Milling Attachment

Attachment designed to convert horizontal bench millers for vertical milling operations. Can be used to quickly adapt Atlas Series M1, MF, and MH milling machines, or any bench miller with a 1 1/2-inch diameter over-arm, for vertical operation. This new low-cost attachment has just been announced by R. Hutchinson & Co., 163 Albany St., New Brunswick, N. J. 112

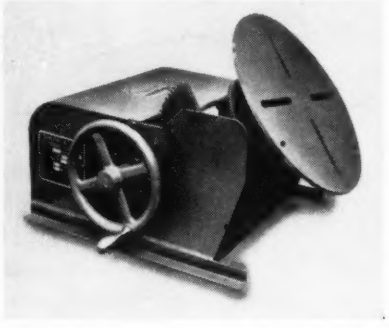
Fairbanks-Morse Motorgears

Motor reducer with axial air-gap "pancake" motor which is less than half the size of conventional type motors and weighs about one-third less. This motor has all the necessary characteristics of steadiness and power. Available in ratings from 3/4 to 10 H.P. Made by Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill. 113



Improved Timer for Injection Molding Machines

Improved timer unit for injection molding machine brought out by the Watson-Stillman Co., Roselle, N. J., for mounting on the base of this company's 12E and 16E "Completeline" machines. The timer unit is mounted directly above the existing control cabinet. It consists of a 14-gage steel cabinet with gray wrinkle finish, which has all instruments required for controlling cycle delay, injection forward operation, injection hold-over periods up to sixty seconds each, curing up to five minutes, die slow-open movement, and stuffer control. A selector switch on the cabinet permits operation of the machine either with or without stuffer control. 114

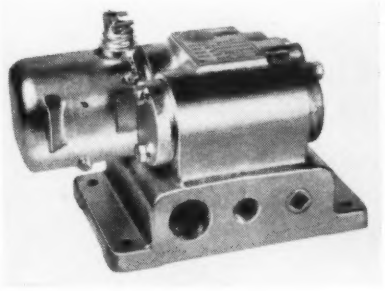


Ransome Work-Positioner

Work-positioner for welding operations, driven by a 1/2-H.P., single-phase, alternating-current motor through a hydraulic variable-speed transmission. This Model I-P positioner, which has a load capacity of 100 pounds, permits all welds to be made in the down-hand position. The table top can be rotated 360 degrees in either direction at any speed from 0 to 5 R.P.M. It can be tilted manually through 135 degrees and locked at any angle by a worm-and-segment arrangement. Especially adapted for such operations as welding, hard-surfacing, assembling, repairing, and grinding. Introduced by the Ransome Machinery Co., Dunellen, N. J., subsidiary of Worthington Pump & Machinery Corporation. 115

Viking Automatic Air Valve

Solenoid-operated "Ring-Seal" air valve embodying new and unusual features recently announced by Viking Products Co., Inc., 2373 E. Eight Mile Road, Hazel Park, Mich. A single interchangeable, quickly replaceable valve assembly is used in all

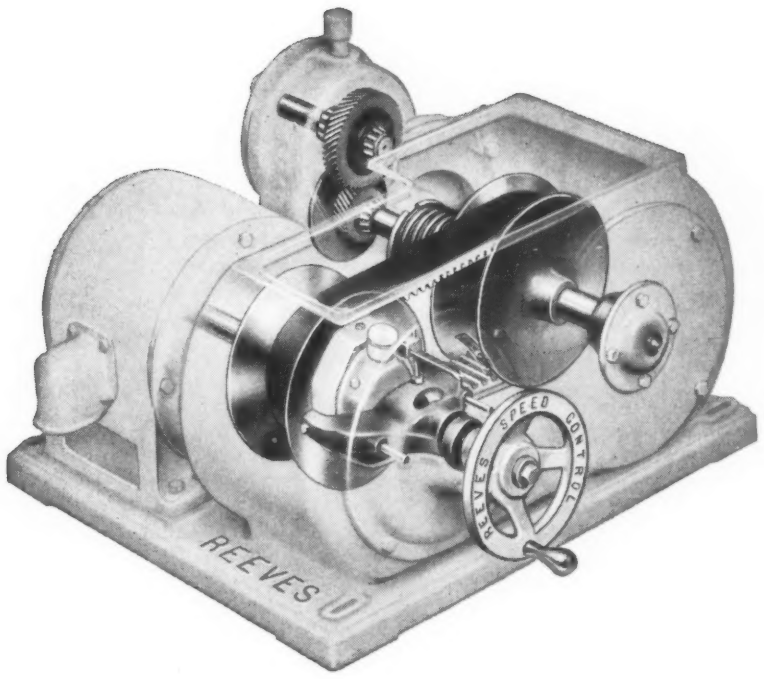


valves in this line up to 3/4 inch and larger, whether three-way or four-way, and whether of the three-, four-, or five-port type. The standard interchangeable valve assembly is of the double opposed type, being completely balanced, reversible, and removable from the valve housing from either end. The valves in this line operate at speeds up to 600 strokes a minute and are designed for use on 110-volt, 60-cycle alternating current, with air pressures up to 105 pounds per square inch or more. Solenoids developed to meet the requirements for other frequencies and voltages can be supplied when desired. 116

Holden Liquid-Electrode Furnace

Liquid-electrode furnace with two or more electrode pools, separated by a ceramic barrier, containing a metal which is molten at operating temperatures. The temperature of the molten pools is from 200 to 600 de-

To obtain additional information on equipment described on this page, see lower part of page 238.



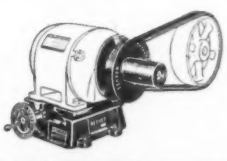
260,000 Testimonials Tell the REEVES Story

These testimonials aren't letters—but machines! They are doing the intricate jobs, the strange jobs and the familiar jobs on production lines in scores of industries, your own included. They are handling materials of widely varying consistency, weight, hardness and temperature . . . steel, textiles, rubber, foods, plastics, glass, pharmaceuticals and many others. They are stamping, grinding, shaping, turning, winding, spreading, cooling, buffing, conveying and so on . . . some under the direction of skilled, experienced operators and others in the hands of awkward newcomers. But this they have in common: *all* 260,000 of these machines are equipped with REEVES Speed Control . . . *all* are performing each and every operation at exactly the right speed to get the best from man, material and machine . . . *all* are proving, through their day-after-day performance, that REEVES holds the key to improved production—cost-wise and quality-wise! Write for copy of 114-page catalog M2-450A.

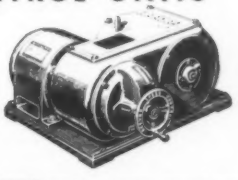
REEVES PULLEY COMPANY • COLUMBUS, INDIANA

THE THREE BASIC REEVES SPEED CONTROL UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive within 4:1 ratio. Sizes to 15 hp.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single compact unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 15 hp.

Accurate Variable

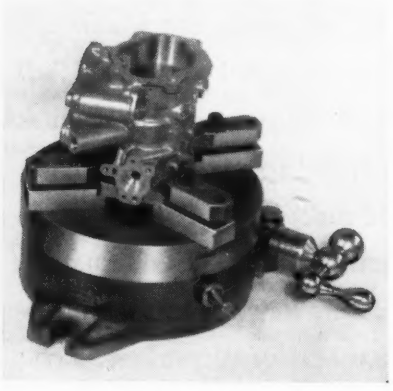
REEVES Speed Control

Gives the Right Speed for Every Job!

grees F. below the operating temperature of the salt bath, which has a range of 1000 to 3000 degrees F. Incorporates new features designed to lower operating and maintenance costs. Can be made in different sizes, with depths ranging from 3 inches to 12 feet, for use in hardening high-speed steels, hardening and annealing stainless steel and tool steels, as well as heat-treating and brazing non-ferrous metals. Pot dimensions of the furnace shown are: Length, 13 inches; width, 9 inches; and depth 19 inches. Can be furnished for operation on 220-, 440-, or 550-volt lines. Made by the A. F. Holden Co., New Haven 8, Conn. 117

Kellner Precision Work-Holding Clamps

The Kellner Tool & Machine Co., 18490 Mt. Elliott, Detroit 34, Mich., has brought out a clamp consisting of two parts of heat-treated steel, which can be used for holding work on lathes, milling machines, planers, indexing tables, etc. The illustration



shows three of these clamps in use on a rotating indexing table for holding a carburetor part. Made in two sizes with 1/2-inch and 3/4-inch high work supporting surfaces. The clamps have three screws—one for adjusting the upper clamping member to a position parallel with the lower block, another for tightening the clamp to hold the work securely, and a third for clamping the device to a T-slot or open slot. 118

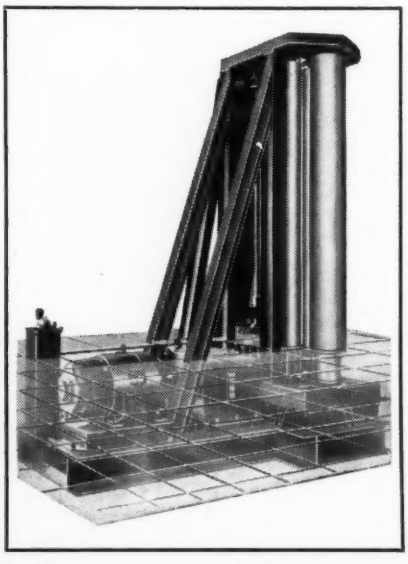
Wire-Mesh Membrane for Titeflex Filter

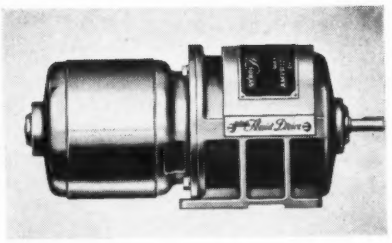
New wire-mesh membrane developed by Titeflex, Inc., 519 Frelinghuysen Ave., Newark 5, N. J., for use on any standard filter made by the company. The membrane consists of a stainless-steel, Dutch-weave, wire cloth, supported on the inside by a perforated cylinder, 1/16 inch thick, with a ring on each end which acts as a bearing surface. The mesh of the standard membrane is 20 by 250, but membranes can be furnished in any mesh required. They can be used with either Filterbestos or diatomaceous earth as filtering mediums, are

interchangeable with the porous stone membranes in Titeflex filters, and will withstand high pressures and high temperatures. 119

Webb Vertical Plate-Bending Roll

Vertical plate-bending roll recently brought out by the Webb Corporation, Webb City, Mo., to supplement its line of horizontal rolls. Designed to facilitate rolling large-diameter cylinders of light plate where true diameters must be held during the bending process. The sheet, handled with a jib crane, is inserted on edge into the machine. As it is ejected from the rollers it maintains a true cylindrical form or shape because horizontal stress on the rolled plate is greatly reduced. 120





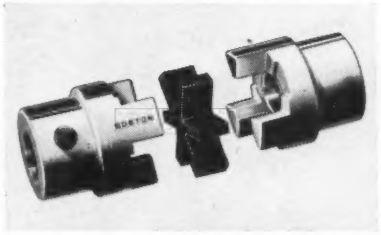
Hydraulic Electric Power Unit

One of a new line of hydraulic electric power units with built-in Gyrol fluid drive. Manufactured by the American Blower Corporation, Detroit 32, Mich., in sizes ranging from 1 to 20 H.P. Each unit has standard NEMA mounting bolt-hole dimensions. All units are furnished complete with electric motors. These drives permit a smooth start and smooth acceleration with a constant-speed, alternating-current motor. The Gyrol fluid drive also provides positive overload protection. Simply changing the oil level adjusts the degree of overload transmitted by the motor. 121

Air-Operated Chipping Hammer

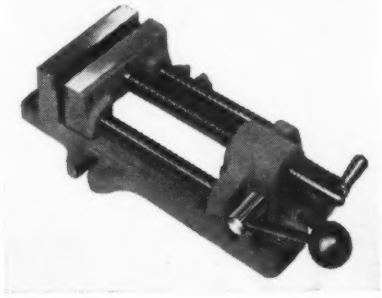
The Chicago Pneumatic Tool Co., 8 E. 44th St., New York 17, N. Y., has brought out a small general-purpose, air-operated chipping tool equipped with jet blower device which effectively cleans off the work surface. Another important feature is the extra smooth throttle action provided by a pulley valve of exclusive design, which can be furnished with either a lever or push type control. In addition to the usual chipping of rust, scale, etc., the tool is suitable for such uses as cutting old windings in electric motor repair shops, chiseling wood in pattern shops, and cutting oil-grooves in large bearings. The tool weighs slightly over 4 pounds, and is about 10 inches long. ...122

To obtain additional information on equipment described on this page, see lower part of page 238.



Flexible Coupling

New flexible coupling of accurately machined three-piece construction with synthetic rubber insert. Available for shafts from 3/8 inch to 1 1/2 inches in diameter. The oil-resistant synthetic rubber insert insures quiet flexible operation. The coupling requires no lubrication and is not harmed by oil, dust, or dirt. It can be used for a wide range of industrial applications requiring flexibility, ruggedness, and durability. Marketed by Boston Gear Works, 55 Hayward St., Quincy 71, Mass. . . 123



Hartmann "Jawset" Production Vises

"Jawset" vise built for production milling and other machining operations. Available in two sizes with 4- and 6-inch jaws having opening capacities of 5 1/8 and 7 inches. Can be adjusted to exert any desired clamping pressure on the work from 0 up to 2 tons. Special features provide for maintenance of accuracy. Made by Hartmann Mfg. Co., 1600 Junction Ave., Racine, Wis. 124

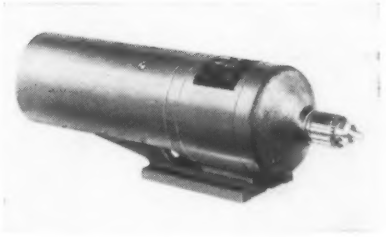
Pyramid "Flexmount" Pyrometer

"Flexmount" pyrometer developed by the Pyramid Instrument Co., 117 Lafayette St., New York 13, N. Y. The swivel mount of this pyrometer affords complete flexibility in its adaptation to all installation requirements, permitting the meter case to be moved in a horizontal arc from 0 to 180 degrees by simply adjusting one set-screw to provide accurate reading in any direction. Flex arms of all sizes and shapes are available to facilitate mounting in ordinarily inaccessible places. The pyrometer can also be furnished for flush or surface mounting. It is completely housed in a metal case, 5 1/4 inches

wide by 3 9/16 inches deep by 2 3/4 inches high, and has a mirrored scale 3 3/4 inches wide. 125

Black Drilling Unit with Single Rotating Member

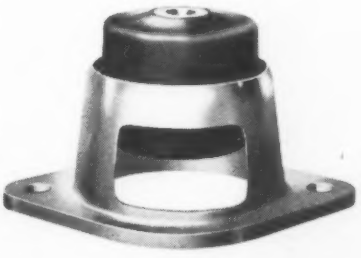
New drilling unit using traversing motor shaft for the work-spindle, which applies torque evenly around the spindle. Air feed provides rapid, shockless advance of the tool to the work, at which point hydraulic control begins and continues the feeding movement until the work cycle is completed. The feed rate remains constant, even when the point of the drill breaks through the material. A micrometer stop insures accurate drilling to depth within limits of 0.001 inch. Drilling units from 1/4 to 1 H.P. have the same dimension from base to center of spindle. Speeds of 840, 1150, 1725, and 3450 R.P.M. are available. Standard units can be operated in any position and can be used for drilling, tapping, centering, chamfering, counterboring, rivet spinning, or any application where a



combination of rotating and traversing motions is required. Brought out by Black Industries, 1400 E. 222nd St., Cleveland, Ohio. 126

Lord Industrial Mountings Designed to Eliminate Vibration

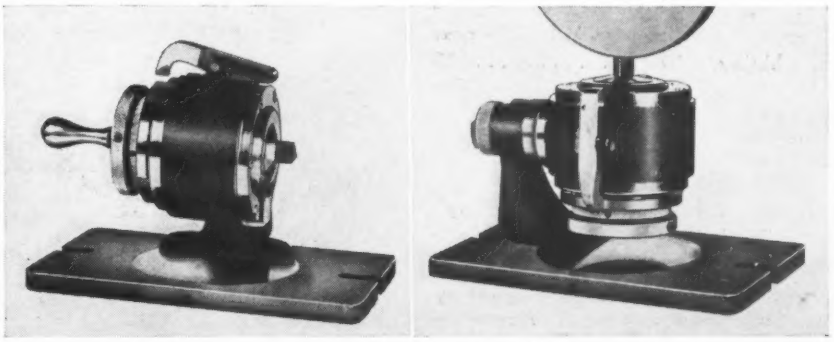
One of a new line of holder type vertical snubbing mountings designed to isolate vibration and control severe shock in machine and equipment installations. Designed for easy installation where the load capacity ranges from 120 to 310 pounds per



mount. The Series 279, 281, and 282 of this line of mountings have deflection limits of 1/8, 3/16, and 1/4 inch, respectively, under load. Developed by Lord Mfg. Co., Erie, Pa. 127

Chip-Breaker Grinding Fixture

Precision fixture that provides for flat or concave grinding of chip-breakers on tungsten-carbide insert type bits. Brought out by the Royal

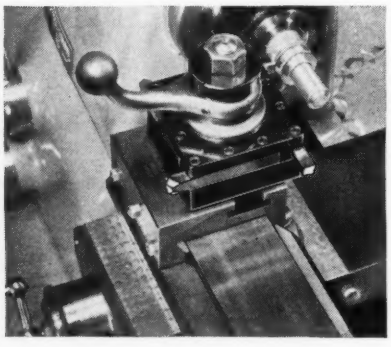


To obtain additional information on equipment described on this page, see lower part of page 238.

Oak Tool & Machine Co., 621 E. Fourth St., Royal Oak, Mich. Spindle runs in preloaded ball bearings, and is ground in the fixture to assure concentricity. This fixture is designed for use with surface grinders, but can also be used with cutter grinders. Clearance from base to face of collet is 5 1/2 inches, permitting vertical positioning under the wheel as shown in view at right. Calibrated scales provide for setting at desired angles, and interchangeable indexplates assure true triangular and square forms. Special collets for square, round, triangular, and rectangular carbide inserts are available in 1/4-, 3/8-, and 1/2-inch sizes for use in this fixture. 128

Hardinge Automatic Square Type Indexing Turret

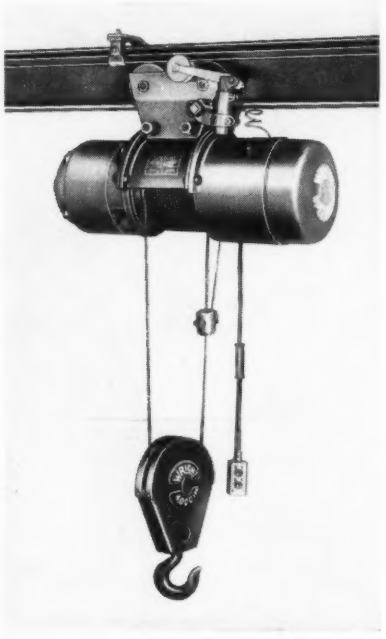
Hardinge Brothers, Inc., Elmira, N. Y., have announced a new square automatic indexing turret for use on the compound slide of this company's precision lathes. Can be applied directly to the toolpost T-slot of the compound slide. The turret takes four standard 5/16-inch square tool



bits. Accurate indexing is accomplished through a hardened and precision-ground tapered index-pin mating with hardened and precision-ground surfaces at each station. The turret can be indexed rapidly by a simple movement of the ball-handled lever, which automatically unlocks the turret, indexes it to the next tool position, and relocks it ready for the next machining operation. 129

All-Steel Wright Speedway Electric Hoist

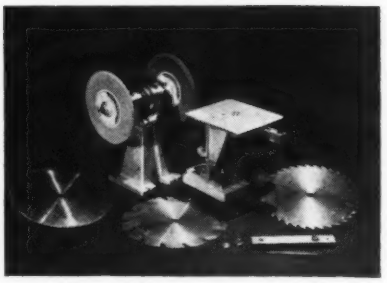
One of a new line of "Speedway" electric hoists made in capacities from 1000 to 20,000 pounds and designed to insure a high degree of efficiency and safety. Features include all-steel construction and "Tru-Lay Preformed" cable with swaged-on fittings. Furnished in lug, hook, plain, or geared Timken trolley types, mounted crosswise or parallel to runway beam, and with motor-driven Timken trolley. Built for operation on alternating or direct current. An-



nounced by Wright Hoist Division of American Chain & Cable Co., Inc., York, Pa. 130

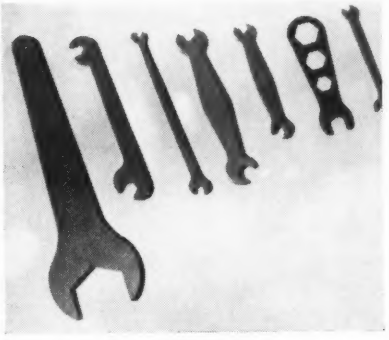
Squirrel-Cage Induction Motor

One of a new line of extra low starting kilovolt-ammeter, 60-cycle, squirrel-cage induction motors announced by Electric Machinery Mfg. Co., Minneapolis 13, Minn. These Design X motors are available in a flange-mounted type, shown in the illustration, and a coupled two-bearing type for direct coupling to 514-, 600-, and 720-R.P.M. air compressors. ...131



Treyco Saw-Sharpening Fixture

Saw-sharpening fixture brought out by Treyco Products, 264 Hartford Ave., Buffalo 17, N. Y., for holding and turning saws to insure precision sharpening and to keep the saw in a perfectly round condition. When the fixture is mounted on the same base as the power-driven grinding wheels, the entire saw-sharpening equipment becomes a self-contained unit. Two wheels of different shapes are used for sharpening three types of circular saws. One wheel with a 45-degree angle on one side is used for sharpening cross-cut or fine teeth on combination saws. The other grinding wheel is 5/16 inch wide and is used for sharpening rip-saw or large combination-saw teeth. ...132



Die-Cut Custom-Made Wrenches

Typical examples of special custom-made wrenches now obtainable in small quantities at low cost from the Dayton Rogers Mfg. Co., 2824 Thirteenth Ave., S., Minneapolis 7, Minn. This service is particularly intended for manufacturers of products requiring special equipment, such as wrenches, which must be designed for and supplied with the products. Wrenches from the smallest size up to a maximum length of 20 inches, in thicknesses of 1/32 to 1/4 inch, can be furnished. They can be produced from any sheet stock, heat-treated and finished to the customer's requirements. 133

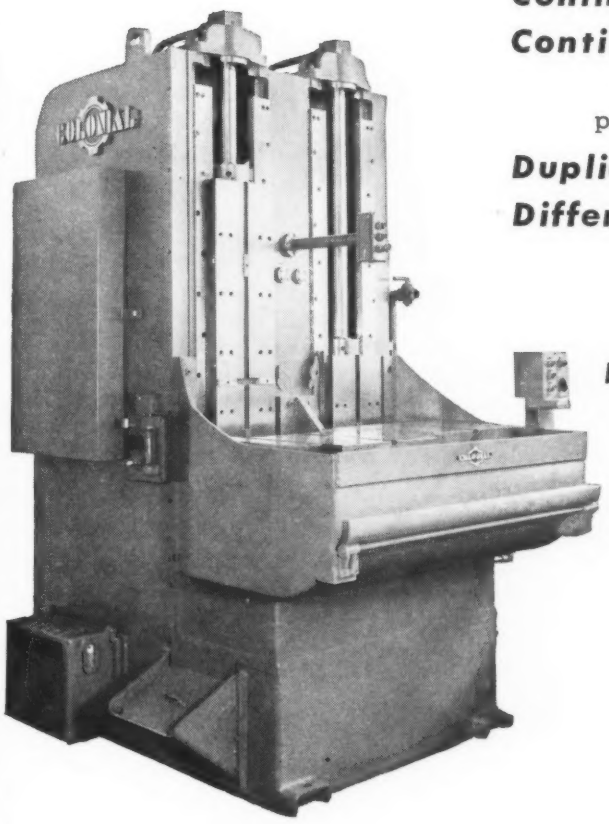
To obtain additional information on equipment described on this page, see lower part of page 238.

#1
+#2
+#3?
+

Another round of wage Raises?

OFFSET THESE COSTS with machines like these—

New COLONIAL DUAL-RAM Surface Broaching Machines



Continuous loading
Continuous cutting
with the rams
performing either
Duplicate operations, or
Different operations, on
the same or
different parts

Now further improved with

All electric controls
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Preselective continuous or single cycling
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Faster set-up
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Minimum down-time for maintenance
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Higher capacity
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and a host of other operating and structural features.

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PIONEERS OF H.S.S. BROACHING
COLONIAL
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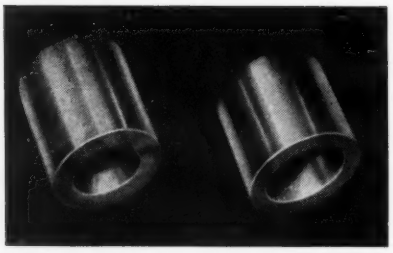
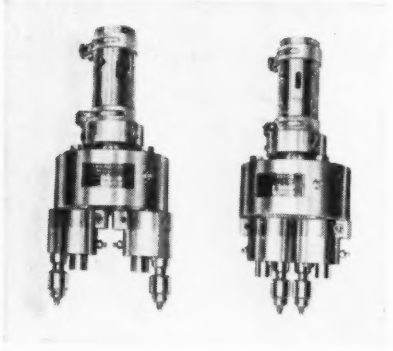


Kennametal Wear-Resistant Bushings

Solid, Grade K6 Kennametal bushings, available for various wear-resistant applications. Made in twelve sizes, with outside diameters ranging from 3/8 to 1 inch, and in lengths and inside diameters to suit the customer's specifications. Supplied rough-molded with just sufficient stock to permit grinding to size. Adapted for use as plain cylindrical plug-gage members, ring gages, and drill jig bushings. Manufactured by Kennametal Inc., Latrobe, Pa. . .134

Errington Adjustable Drilling Head

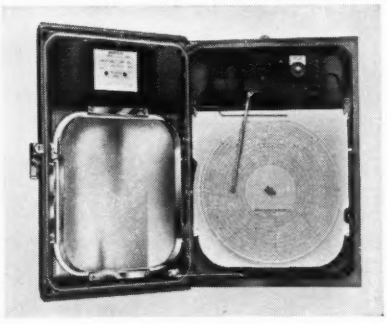
Adjustable drilling head brought out by the Errington Mechanical Laboratory, Inc., Staten Island 4, N. Y. This



tool permits a wide range of adjustment without overhang. The drilling head can be supplied with three spindles for equal adjustment in line and with three, four, five, and six spindles for equal adjustment of spacing on bolt circles. The drill sizes range from 0 to 1 1/2 inches. All parts are fully enclosed for pressure lubrication and protection. Non-slip positive clamping is provided for all adjustable members. 135

Bristol "Running Count" Recording Instrument

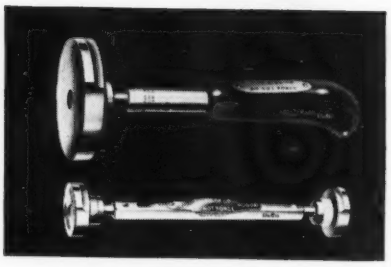
New instrument, known as the "Running Count" recorder, announced by the Bristol Co., Waterbury 91, Conn. Recorder plots curve of number of operations against time on a circular chart. It records the total count of intermittent operations and the time at which each one occurs, and is used on production machinery to record work-producing operations or number of pieces produced. The total number of operations or pieces produced can be easily found by multiplying the number of complete pen traverses across the chart by the count



per traverse for which the instrument is calibrated. The hourly rate of production can also be easily read from the chart. 136

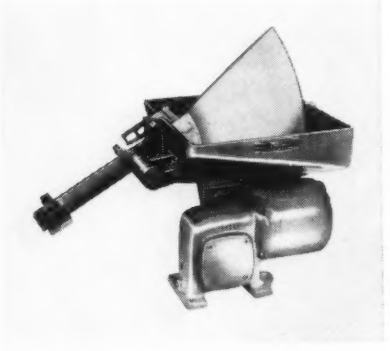
National Acme Chaser for Automatics

"Vers-O-Tool" with blade chasers which are adjustable for wear, designed for use on Brown & Sharpe automatics. This adjustable blade chaser is adapted for use on limited-production lots of both threading and hollow milling work. Each unit is quickly interchangeable with "Vers-O-Tool" equipped circular chaser units normally used for long-run production work. A standard Namco micrometer gage is used to adjust the blade chaser and holder to a predetermined setting on the slide to suit the material to be cut. Chasers and holders in the 3/8- and 9/16-inch Brown & Sharpe sizes are interchangeable. Announced by the National Acme Co., 170 E. 131st St., Cleveland 8, Ohio. 137



"DuBo" Plug Gages

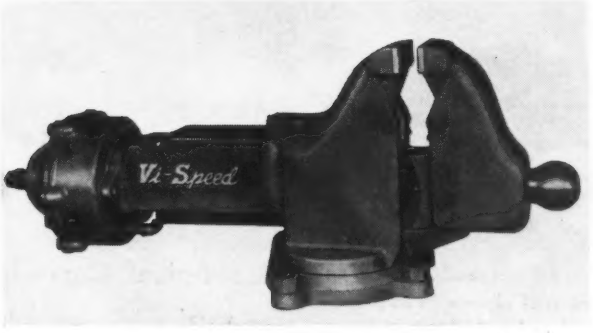
"DuBo" plug gages with hard chromium plating on the gaging surfaces to insure exceptionally long life have been announced by Standard Gage Co., Inc., Poughkeepsie, N. Y. Plain steel DuBo gages, the only kind previously available, are said to have outlasted standard steel cylindrical plug gages six to eight times, based on the number of gaging operations performed before a given amount of wear occurred. The improved gages, having even greater life, are recommended for specially long production runs and for checking the more abrasive materials, such as aluminum castings. The new gages are available in all standard classifications, including that as fine as XX. . . .138



Automatic Hopper Feed

Automatic self-contained hopper feeding unit driven by a 1/4-H.P. gearmotor, which also serves as a mounting pedestal. Will feed many different types of work, such as bolts, machine and wood screws, dowel-pins, chain pins, and numerous other parts. Cylindrical work from 1/8 to 3/8 inch in diameter and up to 4 inches in length can be handled, as well as headed or shouldered work within the same range of diameters and lengths. This unit can be attached to centerless grinders, induction heating machines, punch presses, and many other special machines and fixtures. Placed on the market by Feedall Machine & Engineering Co., 70 Vine St., Willoughby, Ohio. . .139

To obtain additional information on equipment described on this page, see lower part of page 238.

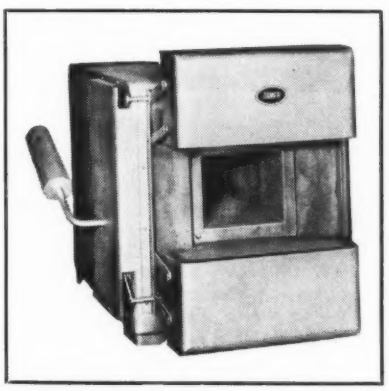


Vi-Speed Air-Powered Vises

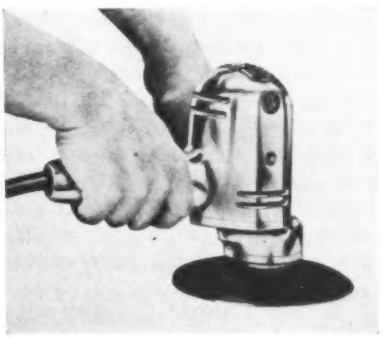
Model 1000 combination machinist and pipe vise, one of a line of three Vi-Speed air-powered vises brought out by the Van Products Co., 1522 Erie Trust Bldg., Erie, Pa. The over-all dimensions of this vise are: Length, with jaws closed, 37 inches; width 12 inches; and height 15 inches. The jaws are 6 inches wide and 1 1/2 inches high, and the ratio of applied pressure to air-line pressure is 50 to 1. This vise weighs 245 pounds. The Model 610-D heavy-duty double-powered vise has an over-all length with the jaws closed of 39 inches; width of 10 1/2 inches; and height of 11 1/2 inches. The ratio of applied pressure to air-line pressure is equal to 100 to 1. The 1000-D combination double-powered vise has an over-all length with the jaws closed of 41 inches. This vise also has serrated and removable work holding or gripping pipe jaws with a ratio of applied pressure to air-line pressure of 100 to 1....140

Temco Electric Furnace

One of a new Series 1700 electric furnaces announced by Thermo Electric Mfg. Co., 507 W. Locust St., Dubuque, Iowa. Door made in two independently controlled sections, designed to permit access to the heating chamber with minimum loss of heat. Supplied with Temcometer temperature controlling and indicating instrument or with an electronic



controlling pyrometer. Can be operated continuously at temperatures up to 1650 degrees F. and intermittently up to 1900 degrees F. Built with a chamber opening 8 1/2 by 7 1/2 inches and in depths of either 13 1/2 or 18 inches to operate on 230-volt, 50- to 60-cycle current. Even heating is assured by nickel-chromium elements embedded in sides, top, and bottom of chamber. ..141

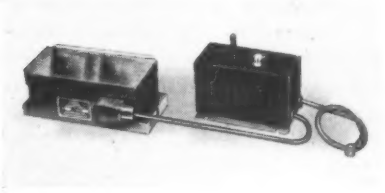


Portable Electric Multi-Purpose Tool

Multi-purpose portable tool announced by the Porter-Cable Machine Co., 1714 N. Salina St., Syracuse 8, N. Y. Especially designed for heavy grinding, polishing, drilling, and cutting operations through the use of simple interchangeable attachments. Will drill up to 1/4-inch holes in metal and 1/2-inch holes in wood. The drill chuck can be used for holding numerous standard attachments, such as hole saws, wire brushes, cup grinders, abrasive points, etc. The tool is 11 1/8 inches long and weighs 5 pounds 13 ounces. 142

Magnetic Chuck and Rectifier

The Hanchett Magna-Lock Corporation, Big Rapids, Mich., is producing a new magnetic chuck for use on small machines and for bench work. It is designated as Model HR-510-C, and is precision-built with the same laminated faceplate design used in the larger Magna-Lock models. The work-pieces are held to the extreme edges of the faceplate, which provides 22 per cent more magnetic area and uniformly distributes the holding power. The chuck is made moisture-proof and impervious to coolants or cutting oils by the Hermeti-Coil construction. It has a 5- by



10-inch working surface and is 4 inches high. The unit is furnished with a separate rectifier and built-in switch, ready to be plugged into an alternating-current electric line..143

Heavy-Duty "Kennamatic" Square- and Round-Nose Planer Tools

Four heavy-duty "Kennamatic" tools are now available from Kennametal Inc., Latrobe, Pa. Two of these tools have square inserts and two have cylindrical inserts of solid Kennametal cemented carbide. The cylindrical inserts, such as shown in the upper view of the illustration, are 1 1/2 inches in diameter by 2 1/4 inches long and are held in 2- and 3-inch square steel shanks. These tools are intended primarily for machining cast iron. The heavy-duty styles with square inserts, such as shown in the bottom view of the illustration, are also available in two shank sizes—one size 2 inches square having

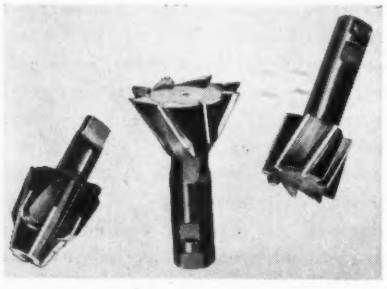
To obtain additional information on equipment described on this page, see lower part of page 238.

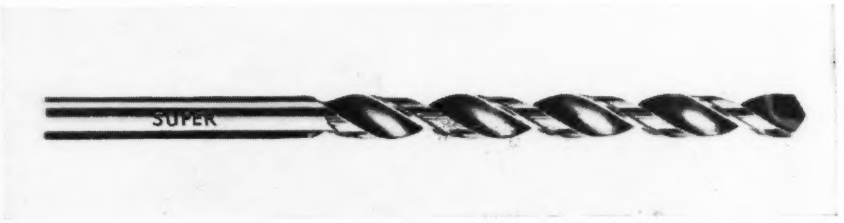
1- by 1 1/2-inch square Kennametal inserts, while the other, which has a 3-inch square shank, has 1 1/4- by 2-inch square inserts.

The company is also supplying brazed-on tools for planing cast iron on modern types of planers having a clapper-box lifting device. These tools have tips of the new exceptionally strong Grade K1 Kennametal and are available in two styles—a square-nose style for finishing when feed per stroke is almost as great as the tool width, and a round-nose style, such as shown in the central view of the illustration, for planing in a trough by "plunging" and feeding both ways. The square-nose tool is made in six shank sizes, ranging from 1/2 inch by 2 inches up to 1 1/2 by 3 inches. 144

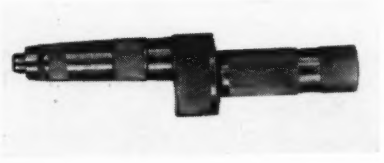
Carbide-Tipped Reamers and Cutters

Three carbide-tipped tools brought out by U. S. Carbide Tool, Inc., 3266 E. 49th St., Cleveland 4, Ohio. The special form reamer shown at left takes five cuts at one pass, including end, taper, face, chamfer, and outside-diameter cuts. The tool at the right is a carbide-tipped right-hand





spiral, right-hand cut end-mill. The carbide-tipped tool shown in the center is a right-hand spiral, right-hand cut form-milling cutter. The tungsten-carbide inserts in these tools are electronically brazed to the faces of the cutting points. 145



Wyco Grinder Hand-Piece with Speed Step-Up

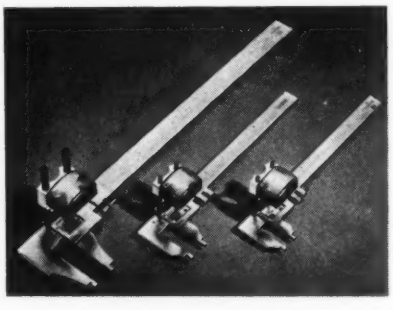
Step-up hand-piece designed to increase the grinding speeds of all Wyco grinders three times. Brought out by Wyzenbeek & Staff, Inc., 838 W. Hubbard St., Chicago 22, Ill. By means of this gear step-up, speeds up to 5000 R.P.M., or higher, can be obtained for 1/4-inch mounted wheels, carbide cutters, rotary files, abrasive rolls, etc. On standard 3600-R.P.M. single-speed grinders, the operator can now obtain speeds of over 10,000 R.P.M. For carbide cutters, the No. 1300 hand-piece gives speeds up to 33,000 R.P.M. Collets 1/4 inch or 1/8 inch will fit the new hand-piece. 146

Fast-Spiral Carbide Drills

Fast-spiral carbide-tipped drill brought out in sizes from 3/16 to 1/2 inch in diameter, inclusive, by the Super Tool Co., 21650 Hoover Road, Detroit 13, Mich. The new drills are also available in corresponding letter and wire sizes. They have straight shanks, and are designed to meet the need for carbide-tipped drills for deep-hole drilling in aluminum, magnesium, and soft plastics. 147

Magna Eye for Reading Scales on Vernier Calipers

Vernier calipers equipped with a "Magna Eye" for magnifying the fine vernier scales. Obtainable in three sizes to fit Brown & Sharpe and Starrett calipers and height gages. Made by Stebar Co., 711 W. Lake St., Minneapolis 8, Minn. 148



To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description — or write directly to the manufacturer, mentioning machine as described in February, 1949, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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[This service is for those in charge of shop and engineering work in manufacturing plants.]

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New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 244 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the February, 1949, Number of MACHINERY

Air and Hydraulic Pressure and Flow Charts

MILLER MOTOR CO., 4027 N. Kedzie Ave., Chicago 18, Ill., is distributing without charge pressure and flow charts for air and hydraulic cylinders, arranged for fast, convenient reference. One table gives push and pull stroke pressures for various cylinder sizes with different piston-rod diameters; another table lists pipe sizes required for well designed hydraulic circuits, and indicates friction pressure loss for different pipe sizes; while a third table recommended piston-rod diameters for various loadings and mounting conditions. 1

Combination Turning Tools

R AND L TOOLS, 1825 Bristol St., Nicetown, Philadelphia 40, Pa. Catalogue descriptive of combination right- and left-hand turning tools which take the place of fourteen separate tools. Circular on new R and L universal toolpost, tap- and die-holders, floating drill holders, back-rest holders for turrets, and knurling tool. 2

Variable-Speed Drives and Controls

REEVES PULLEY CO., Columbus, Ind. Bulletin GN-487, entitled "Reeves Automatic Production Control," describing Reeves hydraulic automatic control, mechanical automatic control, and differential automatic control, as well as various speed indicating mechanisms. 3

Fluorine Corrosion

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York 5, N. Y. Technical report on fluorine corrosion, discussing high-temperature attack on metals by fluorine and by hydrogen fluoride, and the resistance of nickel, Monel, and other materials to these corrosive agents at various temperatures. 4

Precision Tool-Room Lathes and Turret Lathes

SOUTH BEND LATHE WORKS, 383 E. Madison St., South Bend 22, Ind. General catalogue 100-G (64 pages), containing illustrations and specifications covering all the major products of the company, including precision quick-change gear and tool-room lathes, turret lathes, and the new South Bend precision drill press. 5

Machining Meehanite Castings

MEEHANITE METAL CORPORATION, Pershing Square Bldg., New Rochelle, N. Y. Bulletin 29, entitled "How to Machine Meehanite Castings," containing data on feeds, speeds, depths of cut, type of tool, etc., to be used in machining different types of Meehanite castings on machine tools. 6

Die-Casting Machines

HYDRAULIC PRESS MFG. CO., 1042 Marion Road, Mount Gilead, Ohio. Bulletin 4803, entitled "For Low-Cost Metal Parts," discussing the advantages of hydraulic die-casting for producing precision metal parts, and describing submerged-plunger and cold-chamber types of hydraulic die-casting machines. 7

Magnetic Equipment

DINGS MAGNETIC SEPARATOR CO., 4740 W. McGeogh Ave., Milwaukee 14, Wis. Bulletin B-1205A, descriptive of high-intensity Perma-Plate Alnico magnets for removing tramp iron from various materials. Bulletin B-1003A, on electromagnetic concave rolls for high-speed handling of steel and iron pipe. 8

Aeronautical Materials Specifications

HELI-COIL CORPORATION, 47-23 Thirty-fifth St., Long Island City 1, N. Y. Sheets containing aeronautical materials specifications Nos. 7245 and 7247, approved by the S A E, for Heli-Coil screw thread inserts in corrosion-resistant steel and in bronze, respectively. 9

Contour Sawing Machines

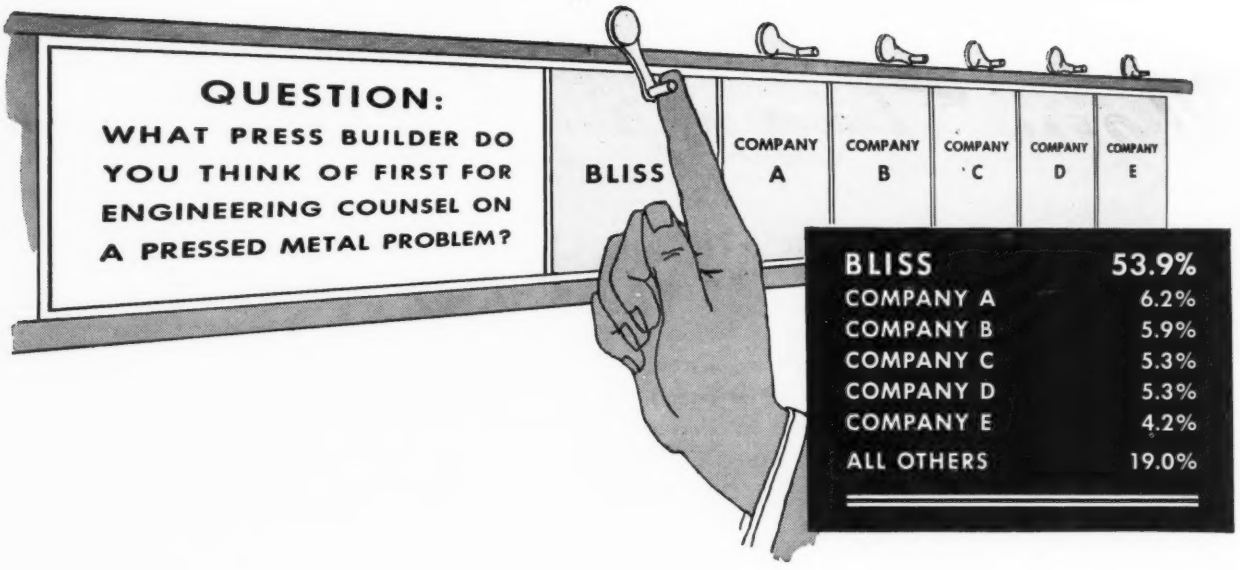
DOALL CO., Des Plaines, Ill. Catalogue entitled "They Cover the Field," describing thirteen high-speed DoAll "Zephyr" contour band-sawing machines, including models ranging from 425 pounds weight with 16-inch throat to 5640 pounds with a 60-inch throat. 10

Universal Tester

W. C. DILLON & CO., INC., 5410 W. Harrison St., Chicago 44, Ill. Bulletin L, descriptive of the Dillon Model L universal tester, a precision instrument for testing the tensile strength of materials from a few pounds to 160,000 pounds per square inch. 11

Permanent Magnetic Drum Separators

ERIEZ MFG. CO., 553 E. 12th St., Erie, Pa. Bulletin 601, illustrating and describing a new line of non-electric permanent magnetic



How press users voted on this vital question

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Such overwhelming preference for "BLISS" is confirmed on pressed-metal production lines everywhere. Let's look at just a few case examples:

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BLISS BUILDS MORE TYPES AND SIZES OF PRESSES THAN ANY OTHER COMPANY IN THE WORLD

drum separators for the automatic removal of tramp iron from various materials conveyed by spouts, chutes, etc. 12

Zinc Die-Castings

NEW JERSEY ZINC CO., 160 Front St., New York 7, N. Y. Booklet entitled "Zinc Die Castings in Ever Widening Fields," containing 63 pages of photographs illustrating the use of zinc die-castings in the assembly of 167 products in ten different fields. 13

Cabinet Forming Machines

CYRIL BATH CO., 6955 Machinery Ave., Cleveland 3, Ohio. Catalogue C-700, illustrating many different types of forming and bending machines for manufacturing metal cabinets, cases, etc. Also shown are press brake dies for bending, flanging, and beading. 14

Engineering Service

CONNECTICUT TELEPHONE & ELECTRIC DIVISION OF GREAT AMERICAN INDUSTRIES, INC., Meriden, Conn. Booklet 2500, describing the company's machine shop and other facilities for designing and producing tools and component parts to customers' specifications. 15

Milling Machines

GEORGE GORTON MACHINE CO., 1301 Racine St., Racine, Wis. Catalogue illustrating and describing the new Gorton No. 2 plain type horizontal milling machine with "Fullwidth" knee, designed for heavy cuts and maximum performance with carbide cutters. 16

Hard-Surfacing Electrodes

LINCOLN ELECTRIC CO., Cleveland 1, Ohio. Bulletin 466, entitled "Lincoln Weldirectory for Hard Surfacing," containing technical information on arc-weld surfacing, and the application of Lincoln electrodes in this operation. 17

Photo-Electric Control

PHOTOSWITCH, INC., 77 Broadway, Cambridge 42, Mass. Bulletin PA 478, illustrating and describing the new Type 20DJ1 photo-electric control for general industrial and machinery applications, such as counting, conveyor control, inspection, etc. 18

Worm-Gear Speed Reducers

CLEVELAND WORM & GEAR CO., 3293 E. 80th St., Cleveland 4, Ohio. Bulletin entitled "More Horsepower per Dollar with Speedaire," presenting case histories of typical Speedaire worm-gear speed reducer installations...19

Laboratory Milling Cutters

SEVERANCE TOOL INDUSTRIES, INC., 636 Iowa St., Saginaw, Mich. Bulletin 16-LM, containing specifications on the line of small ground high-speed steel milling cutters for use in manufacturing jewelry, diesel injectors, aircraft parts, die-castings, etc. 20

Horizontal Boring Machines

GIDDINGS & LEWIS MACHINE TOOL CO., Fond du Lac, Wis. Loose-leaf sheets containing case histories on various machining problems handled on the G & L horizontal boring, drilling, and milling machine. 21

Surface Grinding Machines

BROWN & SHARPE MFG. CO., Providence 1, R. I. Circular containing complete specifications on the Brown & Sharpe Nos. 2L and 2LB surface grinding machines with automatic lubrication. 22

Industrial Dust Collector

AGET-DETROIT CO., 317 Main St., Ann Arbor, Mich. Bulletin containing specifications and ratings covering Midget Model 335 Dustkop dust collector and recommendations for its installation on small grinders and sanders. 23

Hydraulic Stretch-Forming Machines

HUFFORD MACHINE WORKS, INC., Redondo Beach, Calif. Bulletin DGE 1148, describing stretch-forming operations and various models of stretch-forming machines. 24

Materials-Handling Equipment

AMERICAN MACHINE & FOUNDRY CO., 485 Fifth Ave., New York 17, N. Y. Folder descriptive of the "Lowerator," which automatically raises and lowers materials to the working level. 25

Tool-Room Supplies

NORTHWESTERN TOOL & ENGINEERING CO., 117 Hollier Ave., Dayton 3, Ohio. Circular listing various tool-room supplies made by this company, including T-nut and stud sets, step block sets, jig and fixture parts, and screws...26

Double-Ram Broaching Machine

LAPOINTE MACHINE TOOL CO., Hudson, Mass. Folder presenting specifications and new design features of the company's double-ram variable-speed hydraulic surface broaching machine. 27

High-Speed Steel Symbols

GORHAM TOOL CO., 14400 Woodrow Wilson Ave., Detroit 3, Mich. Sixth edition of a booklet containing classification and symbols for the identification of high-speed steels; includes trade names of different companies' products...28

Diamond-Impregnated Drills

FISH-SCHURMAN CORPORATION, 230 E. 45th St., New York 17, N. Y. Circular DT330, on "Steelset" diamond-impregnated drills for drilling presintered cemented carbides, glass, ceramics, and other non-metallic materials.....29

Industrial Measuring Microscope

R. Y. FERNER CO., 110 Pleasant St., Boston 48, Mass. Booklet descriptive of the Cooke Works measuring microscope suitable for a wide range of applications, including very large work. 30

Curved-Tooth Files

AMERICAN SWISS FILE & TOOL CO., Elizabeth 1, N. J. Bulletin listing a complete line of more than 150 different shapes, cuts, and sizes of milled, curved-tooth files for metals, alloys, and hard, non-metallic substances. 31

Machine Parts and Accessories

GEORGE F. BUB & SON, 11403 Madison Ave., Cleveland 2, Ohio. Catalogue 49, listing standard parts and accessories for tools and machinery, such as knobs, screws, washers, keys, etc. 32

Electric Furnaces

C. I. HAYES, INC., 163 Baker St., Providence, R. I. Catalogue 110, entitled "Hayes 'Certain Curtain' Electric Furnaces," describing controlled-atmosphere electric furnaces. 33

Milling Machines

CINCINNATI MILLING MACHINE Co., Cincinnati 9, Ohio. Catalogue M-1662, illustrating and describing the design features of Cincinnati Nos. 2ML and 2MI milling machines. 34

Vertical Indexing Machines

DAVIS & THOMPSON Co., 6411 W. Burnham St., Milwaukee 14, Wis. Bulletin 160, outlining the features of construction of the Davis & Thompson "Roto-Matic" vertical indexing machines. 35

Machine Tool Drives

ALLIS-CHALMERS MFG. Co., Milwaukee 1, Wis. Pamphlet illustrating applications of Allis-Chalmers motors, drives, controls, and coolant pumps on various types of machine tools. 36

Drilling Machines

SIBLEY MACHINE & FOUNDRY CORPORATION, South Bend 23, Ind. Catalogue 68, describing the improved features of the Sibley Models D-24 and D-28 drilling machines. 37

Chain Sprocket Data

CULLMAN WHEEL Co., 1348 W. Altgeld St., Chicago, Ill. Catalogue 48, containing 80 pages of data on roller block and silent chain, as well as chains on reducers and punch-press drives. 38

Precision Feed Controller

NATIONAL PNEUMATIC Co., Industrial Division, Rahway, N. J. Bulletin DC-208, descriptive of a new precision auxiliary control for feeding mechanisms, known as the "Power Check." 39

Industrial Thermometers

W. C. DILLON & Co., INC., 5410 W. Harrison St., Chicago 44, Ill. Bulletin T, outlining the features of the new Dillon stainless-steel thermometer, with heat-resistant dial, for industrial use. 40

Induction Heaters

ELECTRIC ARC, INC., 152-162 Jelliff Ave., Newark 8, N. J. Circular listing induction heaters and control instruments for preheating before welding and stress relieving after welding. 41

Carbide Die and Wear Parts

METAL CARBIDES CORPORATION, Youngstown, Ohio. Catalogue 48-WP, containing 36 pages of information on carbide die and wear parts, including engineering and design data. 42

Sheet-Feeding Tables

LYON - RAYMOND CORPORATION, 7153 Madison St., Greene, N. Y. Bulletin 261, describing the use of hydraulic elevating tables for transporting and feeding strips and sheets. 43

Inclinable Punch Presses

L & J PRESS CORPORATION, Elkhart, Ind. Folder L-8, briefly describing the L & J line of open-back, inclinable punch presses...44

Dial-Feed Tables

A. K. ALLEN Co., 495 Wythe Ave., Brooklyn 11, N. Y. Circular illustrating and describing the Allen new model double-acting dial-feed tables. 45

Helium Shielded Arc-Welding

AIR REDUCTION SALES Co., Department 2328, 60 E. 42nd St., New York 17, N. Y. Reprint of an article "How to Use Helium Shielded-Arc Welding." 46

Electric Laboratory Furnaces

COOLEY ELECTRIC MFG. CORPORATION, 38 S. Shelby St., Indianapolis, Ind. Bulletin 48A, describing the new line of Cooley electric laboratory furnaces. 47

Trucks

YALE & TOWNE MFG. Co., 4530 Tacony St., Philadelphia 24, Pa. Bulletin 2412, containing data on the company's "Power Giant" fork and ram trucks. 48

Reconditioning of Carbide Cutting Tools

RUTLAND TOOL SERVICE, 13006 Greeley Ave., Detroit 3, Mich. Circular on the reconditioning of carbide cutting tools. 49

Cutting Fluid

CINCINNATI MILLING MACHINE Co., Cimcool Division, Cincinnati 9, Ohio. Circular listing the characteristics and advantages of Cimcool cutting fluid. 50

Grinding Machines

BOWEN GRINDERS, INC., Beloit, Wis. Bulletin explaining the basic principle of construction and application of the new Bowen grinder. 51

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation), fill in below the publications wanted using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (February, 1949) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

NAME.....POSITION OR TITLE.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY.....STATE.....

By E.S.S.

BETWEEN GRINDS

The Best on Broaching

Our whole staff is agog about the articles on broaching to be published in March and April MACHINERY. They are so exceptional that we can't resist briefing you—after all, you wouldn't want to miss the best treatment on broaching that has come anybody's way in many a year. As you know, there are many factors entering into the design of surface broaches which cannot be combined for mathematical calculation (variables such as the broaching machine, material to be broached, its shape and general condition, as well as toolmaking facilities and methods). Dr. Artur Schatz of Wuppertal, Germany, has written two articles describing these factors, their relationship to each other, and their combined influence on good broach design. Each article tabulates the various factors that must be considered for different types of surface broaches and different broaching operations. So be alert for "Important Factors in the Design of Surface Broaches."

A Book is Born

In January, The Industrial Press introduced on the market a most comprehensive book entitled "Mathematics at Work." Lineally speaking, we felt very close to this book—it was written about six feet away from our desk by one of MACHINERY'S associate editors. Optically speaking, we watched the author, Holbrook L. Horton, cope with difficult problems for approximately three years, searching for their clear, simple presentation and proving their accuracy on an electric computing machine that sounded like a diligent seamstress. Tangentially speaking (basking in a mathematical orbit influences one's vocabulary), our attention was next held by the planning for the typography of the book, proofreading, indexing, selecting the jacket design, color of the cover, and so on. Then on Christmas Eve, the first bound copy arrived at Mr. Horton's desk and with it the great satisfaction of seeing one's work in solid form.

Labor Advice in Stone

The training of youths for craftsmanship through some form of apprenticeship dates back to 2100 B.C., the date of the Babylonian Code of Hammurabi, which made explicit provision that artisans teach their crafts to youths. — William F. Patterson, Director Bureau of Apprenticeship, U. S. Department of Labor.

Enterprising Salesman Turns Counsel into Currency

O happy day when, feeling that you must be doing good in the dissemination of advice you find that you have done good. Which is all an introduction to the following incident wherein the Metaloc Company of Long Island City distributed copies of the Sales Engineer articles (written monthly by Bernard Lester) to their salesmen and somewhat later "noticed that one salesman in particular, whose volume was just normal, suddenly began producing good volume. When he was asked what brought this on, the salesman stated that after he had read the article in MACHINERY telling how a salesman should plan his approach before he went in to see a prospect, he changed his sales tactics to suit the suggestions, and, he too, was quite surprised with the results. . . . This same salesman just won the monthly prize for bringing in the greatest number of new customers and the greatest volume for the month."

Down Their Alley

The Bureau of Apprenticeship in Washington, it seems, greeted the editorial published in July MACHINERY "Apprentice Training as an Aid to National Security" with so much enthusiasm (the self-same words) that they ran off copies for distribution to their entire staff, including 300 field representatives, as well as to members of the newly organized National Metal-Working Apprenticeship Committee.

Fancy Figures (Numeral)

The Ohmite Mfg. Co. recently received a bill for advertising amounting to $89,800,000. Fast as the human eye can travel, the invoice was looked over, then the accountant figured it up on the Chinese rate of exchange, 251,500 to 1 and OK'd the bill of $35.70, submitted from their representative in China.

File Cabinet in Goldfish Bowl?

From an Indian correspondent: "It is only recently I have succeeded in fishing out your esteemed address. I am very eager to subscribe to your valuable journal . . ."

News of the Industry

California, Oregon, and Washington

LINDBERG ENGINEERING CO., Chicago, Ill., has established a West Coast office at 5531 S. Vermont St., Los Angeles, Calif. STUART K. OLIVER, formerly in charge of the Cleveland office, has been named manager of the new office, which will serve the states of California, Oregon, and Washington.

GEOMETRIC TOOL CO., New Haven 15, Conn., has appointed J. E. HASELTINE & Co., Second Ave. and Ash St., Portland 4, Oreg., with branches at Seattle and Spokane, Wash., distributor for the company in the states of Oregon, Washington, Montana, and Idaho.

RAYBESTOS-MANHATTAN, INC., has opened a new warehouse and office at 314 Occidental Ave., Seattle, Wash., where a complete stock of industrial rubber products will be carried. RUSSELL G. HEUMAN will be in charge of the new office.

Illinois

LEO E. JACOBS has resigned as executive vice-president and director of Charles H. Besly & Co., Chicago, Ill., to become president of the Titan Abrasives Co., also of Chicago. ALBERT J. DOERMANN, formerly president of the Titan Abrasives Co., has been elected chairman of the board. K. Y. TAYLOR, previously vice-president in charge of manufacturing of the Besly organization, has been appointed executive vice-president of the company, succeeding Mr. Jacobs. EVERETT ADDOMS, formerly sales promotion manager, has been made a vice-president of the company.

BLACK & DECKER MFG. CO., Towson, Md., announces that its Chicago sales and service station has been moved to a new building at 1100 W. Jackson Blvd., where double the previous facilities are available. R. G. HORNER is branch manager.

BRUCE E. HORST has been appointed sales representative for the Barber-Colman Co., Rockford, Ill., in the Rockford territory, handling machine tools, hobs, cutters, and reamers. He succeeds E. J. BENESCH.

AMERICAN FLEXIBLE COUPLING CO., Erie, Pa., has appointed EHRET & KINSEY, 327 S. La Salle St., Chicago 4, Ill., selling agents for the company's line of flexible couplings and gear type couplings.

WILLIAM SEYMOUR, JR., has been elected vice-president and C. L. HARDY assistant vice-president of Joseph T. Ryerson & Son, Inc., Chicago, Ill. THOMAS G. MILLER has been made secretary. W. A. REDPATH has been appointed manager of the Philadelphia plant of the company, succeeding C. L. HARDY. The Philadelphia plant has recently undergone changes that will practically double its capacity. A full line of hot-rolled and cold-finished steel is carried in stock at Philadelphia.

Photo Koenig

(Left) William Seymour, Jr., Vice-president, Joseph T. Ryerson & Son, Inc. (Right) C. L. Hardy, Assistant Vice-president

FAIRBANKS, MORSE & CO., Chicago 25, Ill., announces the following changes in the Sales Division: O. O. LEWIS, assistant sales manager, has been promoted to sales manager; HARRY L. HILLEARY, manager of the St. Louis branch, has been made assistant sales manager of the company, with headquarters in Chicago; L. A. WEEM, manager of the Pump Division, has been transferred to St. Louis, succeeding Mr. Hilleary.

H. S. HUNCKE & Co., 230 W. Huron St., Chicago 10, Ill., has been appointed representative in northern Illinois and Iowa for the GORHAM TOOL CO., Detroit 3, Mich.

Indiana

STANWOOD W. SPARROW has been elected president of the Society of Automotive Engineers for 1949. Mr. Sparrow is vice-president in charge of engineering of the Studebaker Corporation, South Bend, Ind. His engineering career closely parallels the history of the automotive industry since his graduation from Worcester Polytechnic Institute in 1911. Mr. Sparrow resigned as chief of the Automotive Power Plant Section of the National Bureau of Standards in 1927 to join the Studebaker Corporation in the field of engine research. Later he became chief research engineer, and during World War II, devoted practically all of his time to Studebaker's aviation project, which was the building of the Wright Cyclone engine for our military services and those of our allies.

R. E. WHINREY, formerly superintendent of the Link-Belt Dodge plant at Indianapolis, Ind., has been appointed to the newly created position of assistant general manager of that plant. L. C. HEINLEIN, previously assistant superintendent, has been appointed superintendent of the plant.

L.G.S. SPRING CLUTCH CORPORATION, DIVISION CURTISS-WRIGHT CORPORATION, Indianapolis 6, Ind., has appointed the following new sales agents: L. R. TWYMAN & ASSOCIATES, Fisher Bldg., Detroit 2, Mich., and VAN RIPER ENGINEERING, INC., 4 Station Square, Rutherford, N. J.

LANDIS TOOL CO., Waynesboro, Pa., manufacturer of precision cylindrical grinding machines, announces the opening of a direct sales and service office in Indianapolis at 709 E. 38th St. A. J. JONES will be in charge as district manager.

SOUNDNESS* is Essential

In Metal-Cutting Tools

In Money Tools

***"Freedom from flaw or defect; firmness, strength, trustworthiness."** Webster*

Cemented carbide tools have been a boon to metal-working industries in their ability to increase production and decrease costs. To do this consistently and at minimum expense for maintenance, they must have soundness and uniformity. These properties are attained to a marked degree in Kennametal by distinctive processing and precise laboratory control throughout every stage of manufacture—from refinement of raw materials to sintering of finished product.

A sound, close-grained physical structure, free from porosity, characterizes all Kennametal compositions—a guarantee of uniform hardness and strength. Superior tool performance is therefore obtained. Reliability and durability are outstanding.

There are eight different grades of Kennametal, and a wide range of tool sizes from which to make selection for specific machining requirements, as listed in Catalog 48. You can buy Kennametal tools and blanks with assurance of highly satisfactory service. They are all efficient performers—money savers on production and maintenance.

Money—important tool of industry and trade—is an instrument for accurately evaluating the worth of goods and services in exchange activities only as it remains firm and trustworthy.

For 15 years we have had "managed" currency, and with it has come uncontrollable inflation. Dollars are plentiful, but "porous". The cost of living—for families and business concerns—has skyrocketed. Uncertainty prevails.

Return to sound money—an honest medium of exchange★—will help stabilize our economy, put a curb on the potentially infinite use of currency, automatically check inflation and dangerous expansion of credit, and restore confidence. Individuals can then know with certainty the worth of earnings and savings; businessmen will be enabled to continue worthwhile enterprises with assurance. Palliatives may ease the pain of economic ills, but sound money is an effective cure.

★ **Bill H. R. 5031** introduced into the House of Representatives, January 20, 1948, by Congressman Buffet of Nebraska cited as the "Gold Standard Act of 1948."

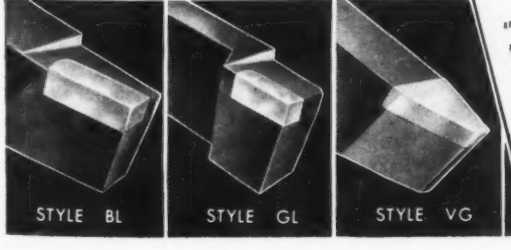
A BILL

"To restore the right of American citizens to freely own gold and gold coins; to return control over the public purse to the people; to restrain further deterioration of our currency; to enable holders of paper money to redeem it in gold coin on demand; to establish and maintain a domestic gold coin standard; and for other purposes."

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

KENNAMETAL Inc., LATROBE PA



STYLE BL STYLE GL STYLE VG

KENNAMATIC STYLE 12TK — KENNAMATIC STYLE 6RK — SERRATED MILLING CUTTER BLADES

Iowa, Minnesota, and Missouri

M. PAUL WAHLUND MECHANICAL LABORATORY, which is engaged in tool, die, and machine work, product development and manufacturing, announces that it has purchased the UNIQUE MFG. CO., of Omaha, Neb., maker of production tools and attachments for small lathes. The new business will be operated as a division of the Wahlund Laboratory. The company has also announced that it has recently moved from its former location at 4724 N. 39th St., Omaha, Neb., into a new plant at Grant, Iowa.

PALNUT CO., Irvington, N. J., manufacturer of lock-nuts and fasteners, has appointed A. A. GUSTAFSON, 2580 University Ave., St. Paul 4, Minn., representative of the company in the Minnesota and Iowa territories.

COLUMBIA TOOL STEEL CO., Chicago Heights, Ill., announces the appointment of GILBERT R. JARMAN as district sales manager of the St. Louis territory, with office at 817 Arcade Bldg., St. Louis, Mo.

Michigan

JOSEPH F. LASK has been appointed general manager of the Modern Collet & Machine Co., Ecorse, Mich., and JOHN L. BRADFORD has been made sales manager. Mr. Lask has been connected with the automotive, tool, and machinery industries in Michigan since 1912. He resigned as factory manager of the Gairing Tool Co. to go to the Modern Collet & Machine Co. Mr. Bradford has been a factory representative with the company since 1945.

ARTHUR M. SWIGERT has been appointed vice-president in charge of all manufacturing operations of the Universal Products Co., Inc., 6455 Kingsley Ave., Dearborn, Mich., manufacturer of universal joints and propeller shafts. Mr. Swigert was previously works manager of the Ingalls Shipbuilding Corporation, Pascagoula, Miss.

GENERAL ELECTRIC CO., Schenectady 5, N. Y., announces that the apparatus department has established a separate sales district for the state of Michigan, with headquarters in Detroit. A. R. HINES has been named manager of the new district, with V. J. SNYDER and C. M. DUNN as assistant managers.

PHILIP J. LINDNER, since 1940 chief engineer of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has been appointed head of the company's Detroit branch sales office at 2842 W. Grand Blvd.

Milton J. Steffes, Recently Appointed General Sales Manager of Super Tool Co.

MILTON J. STEFFES has been appointed general sales manager of the Super Tool Co., 21650 Hoover Road, Detroit 13, Mich. Mr. Steffes has been connected with the company for seven years in the capacity of field engineer, and recently has had charge of the concern's carbide tool research program. Mr. Steffes succeeds HAROLD E. BERRY, who has been obliged to curtail his activities on account of ill health. In the future, Mr. Berry will serve as advertising manager and consultant on sales.

MARVEL TOOL & MACHINE CO., St. Clair, Mich., has appointed G. HENRY KEETON, 6432 Cass Ave., Detroit, Mich., exclusive Michigan representative for the sale of Marveco live centers.

Gordon P. Molsen, Recently Appointed Sales Manager of Chuck and Machine Tool Division, Whiton Machine Co.

OVAL TOOL AND DIE CORPORATION announces its removal to new and larger quarters at 8061 Lynch Road, Detroit 5, Mich.

New England

ALEXANDER S. KELLER, vice-president and manager of foreign sales of Pratt & Whitney, Division Niles-Bement-Pond Co., West Hartford 1, Conn., has accepted the post of Senior Industry Officer in the Netherlands Mission of the Economic Cooperation Administration. The company is granting Mr. Keller a year's leave of absence to permit him to take up this assignment. In the capacity of Senior Industry Officer, Mr. Keller will be the representative of the U. S. Government under Dr. Alan Valentine, chief of the Mission and president of the University of Rochester. It will be Mr. Keller's duty to administer to industrial phases of the European Recovery Program in the Netherlands and Netherlands Indies. HARRY REICHERT will serve as acting manager of foreign sales during Mr. Keller's absence.

©Fabian Bachrach

Alexander S. Keller, Recently Appointed Senior Industry Officer in the Netherlands Mission of the Economic Cooperation Administration

GORDON P. MOLSEN has been appointed sales manager for the Chuck and Machine Tool Division of the Whiton Machine Co., New London, Conn., manufacturer of lathe chucks, centering and gear-cutting machines, and steam turbines.

ARC WELDING CUTS COST 43% ...builds a stronger product

By A. D. NEAL,
Works Manager
B. F. Avery & Co.
Louisville, Kentucky

To avoid structural failures caused by striking hidden stumps or stones has been a major problem in the development of farm tractors and implements. By converting to welded design on key parts like axles and wheels, manufacturing has been simplified and field breakdowns virutally eliminated.

Fig. 1. *Weight reduced 30% . . . cost cut 43%.* Present design, all welded steel front axle. Has pressed steel channel frame and steel spindle housings. Inset shows former construction of cast steel.

IMPROVES DURABILITY

Experience shows that the welded designs have greater strength as well as exceptional resilience to severe mechanical shocks. Building the component parts from fabricated steel also eliminates the chance for any difficulties through inconsistencies in cast metals. Thus, with welded design, greater product dependability is achieved to meet unknown and abnormal operational needs.

Fig. 2. *Stronger and more durable* all welded steel front wheel for farm tractor now used.

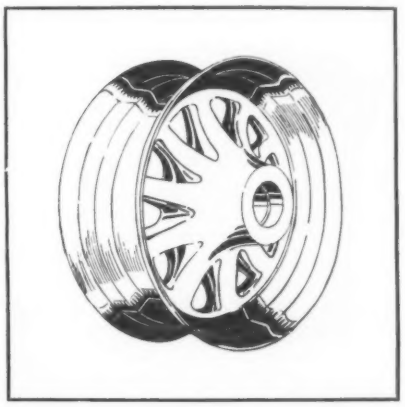


Fig. 3. *Former construction* had cast steel hub welded to rolled steel rim.

SIMPLIFIES MANUFACTURE

Substantial savings in manufacturing costs result in fabricating our tractor and implement parts with arc welding. Less material is required since components are stamped from steel plate or machined from bar stock with high speed equipment. Arc welding is done on simple, quick operating swing-type fixtures permitting fast downhand welding. On most jobs, no further machining is required after welding.

Fig. 4. *Cost cut 62% . . . weight down 69%.* Weld-fabricating a front tractor wheel. Component parts shown on table are located in simple fixture for welding.

The above is published by **THE LINCOLN ELECTRIC COMPANY** *in the interests of progress.*
Machine Design Studies available to engineers and designers. Write The Lincoln Electric Company, Dept. 22, Cleveland 1, Ohio.

AMERICAN OPTICAL CO., Southbridge, Mass., has recently purchased a six-acre tract of land at Stamford, Conn. The property includes a building containing 13,000 square feet of floor space, which will be remodelled to house a research laboratory as part of the company's research program. The activities to be conducted in the new laboratory will supplement the research carried on at the company's headquarters in Southbridge and at the scientific instrument division in Buffalo, N. Y.

AMERICAN STEEL & WIRE CO., Rockefeller Bldg., Cleveland 13, Ohio, announces the following changes in the operating personnel of the Spring Mill and Rail Bond Division of the company at South Works, Worcester, Mass.: RAYMOND E. TIBBETTS has been named division superintendent, succeeding HARRY F. CLARKE, who has resigned; HAROLD J. ELMENDORF has been appointed chief spring engineer; and ERICK R. KARLSON has been made division supervisor, production planning.

ROGER HUBBELL has been appointed district sales engineer for the Threadwell Tap & Die Co., Greenfield, Mass. He will cover the New England territory, making his headquarters at Needham, Mass., just outside of Boston.

New Jersey

RICHARD M. SOMERS has been made chief engineer of the Ediphone Division of Thomas A. Edison, Inc., West Orange, N. J. He has been connected with the company since 1928, formerly serving as chief engineer and factory superintendent of the Lamp Division. Since 1936, he has been assistant chief engineer of the Ediphone Division. Mr. Somers succeeds SAMUEL C. LANGLEY, who will assume the duties of consulting engineer.

DE LAVAL STEAM TURBINE CO., Trenton, N. J., recently announced the following executive changes: HENRY W. JOHNSON is retiring as vice-president in charge of manufacturing, but will continue as director and a member of the executive committee; C. RICHARD WALLER has been named vice-president and director for engineering and H. G. BAUER has been elected vice-president and executive engineer.

A. H. LUNDIUS has been appointed plant manager of the Clark Township plant of the Hyatt Bearings Division, General Motors Corporation, Harrison, N. J., succeeding J. C. HENNY, who retired on January 1. Mr. Lundius was previously assistant plant manager at the Clark Township plant.

HAROLD F. SMIDDY has been elected a vice-president of the General Electric Co., with headquarters at Bloomfield, N. J. He will continue to serve as general manager of both the air-conditioning and chemical departments of the company.

FRANK J. WHELAN, vice-president of the Worthington Pump & Machinery Corporation, Harrison, N. J., has been placed in charge of the sale of welding positioners and turning rolls manufactured at the corporation's Dunellen, N. J., works.

BERNARD H. MCGUINESS, for three years works manager of the Passaic, N. J., plant of Hewitt-Robins, Inc., materials-handling machinery manufacturer, has been appointed vice-president of the company's Robins Conveyors Division.

New York

LEO B. GRANT has been appointed manager of the New York sales office of the Dow Chemical Co., Midland, Mich., succeeding RALPH E. DORLAND, who died last May. Mr. Grant had been associated for twenty years with the Magnesium Division of the company in Midland before joining the executive staff of the New York office about a year ago.

FORD INSTRUMENT CO., INC., 31-10 Thomson Ave., Long Island City 1, N. Y., has merged into its parent company, the SPERRY CORPORATION, and hereafter will be known as the Ford Instrument Co. Division of the Sperry Corporation.

M. J. L. SCHULTE has been made general sales manager of the Stow Mfg. Co., Binghamton, N. Y. Prior to his present appointment, he was employed in a sales and administrative capacity with the Keystone Bolt & Nut Corporation of New York City.

PHILIP H. CLAPP, JR., formerly sales representative of the Engineered Castings Division of the American Brake Shoe Co., Rochester, N. Y., has been appointed sales manager of the division.

POLYTECHNIC RESEARCH AND DEVELOPMENT CO., INC., formerly located at 66 Court St., Brooklyn, N. Y., announces the opening of new and expanded research laboratories at 202 Tillary St., Brooklyn.

Ohio

ACRO ELECTRIC CO., Cleveland, Ohio, manufacturer of rolling spring snap-action switches, has been purchased by a group of Pittsburgh businessmen, including WILLARD F. ROCKWELL, JR., president of the Rockwell Mfg. Co. F. G. MCCLOSKEY is the new president of the company, while FRED LYNN remains vice-president and general manager.

AMERICAN STEEL & WIRE CO., subsidiary of UNITED STATES STEEL CORPORATION, Cleveland, Ohio, announces the establishment of a Stainless Steel Products Sales Division, with BANKS E. EUDY as manager. C. RICHARD HORWEDEL will serve as assistant manager.

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio, announces the promotion of the following men: DAVID M. STRAUCHEN, general shop superintendent since 1931, has been made manager of a new Special Products

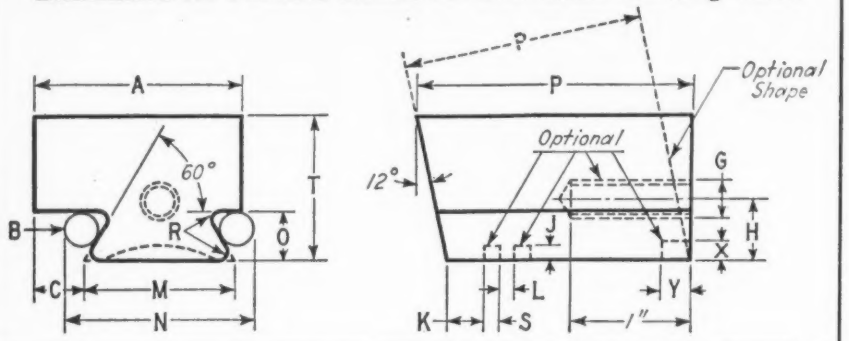
Photo Carlson

(Left) David M. Strauchen, Manager of New Special Products Division, Cincinnati Milling Machine Co. (Right) Alfred T. Blackburn, General Shop Superintendent

STANDARD DOVETAILED FORMING TOOL BLANKS—2

Prepared by the American Society of Mechanical Engineers and Approved by American Standards Association

Dimensions for Finished Blanks for Dovetailed Forming Tools



Group No.	Basic Blank Size*	Width A		Thickness T		Length P	Dovetail			
		Max.	Min.	Max.	Min.		Width M†	Height O	Radius R	To Face C
1	1	1 1/32	1 1/64	29/32	57/64	1 1/2	0.732	9/32	1/32	1/4
	1 1/4	1 9/32	1 17/64	29/32	57/64	1 1/2	0.951	19/64	1/32	19/64
2	1 1/4	1 9/32	1 17/64	29/32	57/64	2	0.951	19/64	1/32	19/64
	1 1/2	1 17/32	1 33/64	29/32	57/64	2	0.951	19/64	1/32	19/64
	1 3/4	1 25/32	1 49/64	1 5/32	1 9/64	2	1.250	13/32	1/16	7/16
	2 3/4	2 25/32	2 49/64	1 5/32	1 9/64	2 7/16	2.000	33/64	1/16	1/2
3	1 3/4	1 25/32	1 49/64	1 5/32	1 9/64	2 7/16	1.250	13/32	1/16	7/16
	2 1/4	2 9/32	2 17/64	1 5/32	1 9/64	2 7/16	1.250	13/32	1/16	7/16
	2 3/4	2 25/32	2 49/64	1 5/32	1 9/64	2 7/16	1.250	13/32	1/16	7/16
4	2 3/4	2 25/32	2 49/64	2 17/32	2 33/64	2 5/8	1.614	35/64	1/16	1/2
	2 3/4	2 25/32	2 49/64	2 17/32	2 33/64	2 5/8	1.882	35/64	1/16	1/2
	3	3 1/32	3 1/64	2 17/32	2 33/64	2 5/8	1.882	35/64	1/16	1/2
5	2 3/4	2 25/32	2 49/64	1 9/32	1 17/64	2 7/16	2.000	33/64	1/16	1/2
	2 3/4	2 25/32	2 49/64	3 1/32	3 1/64	3	2.000	33/64	1/16	1/2
	3	3 1/32	3 1/64	3 1/32	3 1/64	3	2.000	33/64	1/16	1/2
	3 1/4	3 9/32	3 17/64	3 1/32	3 1/64	3	2.000	33/64	1/16	1/2
6	3 1/4	3 9/32	3 17/64	3 17/32	3 33/64	4	2.238	35/64	1/16	9/16
	3 1/2	3 17/32	3 33/64	3 17/32	3 33/64	4	2.883	43/64	1/16	5/8
	4	4 1/32	4 1/64	3 17/32	3 33/64	4	2.883	43/64	1/16	5/8
	4 1/2	4 17/32	4 33/64	3 17/32	3 33/64	4	2.883	43/64	1/16	5/8

All dimensions are given in inches.
*Blanks made of high-speed steel shall be stamped H.S.
†Dovetail width M is to the theoretical sharp corners.

STANDARD DOVETAILED FORMING TOOL BLANKS—1

Prepared by the American Society of Mechanical Engineers and Approved by American Standards Association

Screw Machine Classification

The group numbers here given are used in Data Sheets on Standard Dovetailed Forming Tool Blanks No. 628 and No. 629 (to be published in March MACHINERY).

Group Number	Type of Machine	Maximum Capacity*
1	No. 00 Brown & Sharpe	3/8
	No. 19 Brown & Sharpe	3/8
	Index "0"	7/16
	3/8-inch Cleveland	5/8
2	3/8-inch Gridley	3/8
	1/2-inch Davenport	7/8
	9/16-inch Acme Gridley	9/16
	No. 0 Brown & Sharpe.	5/8
	5/8-inch Cleveland	3/4
	5/8" by 7/8" Cleveland	1 1/16
	No. 204 New Britain	5/8
	7/8-inch Greenlee	1
	7/8" by 1 1/4" Cleveland	7/8
3	7/8-inch Gridley	7/8
	1-inch Acme Gridley	1
	No. 172 New Britain	1
	No. 2 Brown & Sharpe.	1 1/8
	1 1/4-inch Gridley	1 1/4
	1 1/4-inch Cleveland	1 1/4
	1 1/4-inch Cleveland	1 3/8
	1 1/4" by 1 1/2" Cleveland	1 3/4
	1 1/4" by 1 1/2" Cleveland	1 1/2
	1 1/4-inch Greenlee	1 1/4
	1 3/8-inch Gridley	1 3/8
	1 1/2-inch Greenlee	1 1/2
	1 5/8-inch Gridley	1 5/8
4	1 5/8-inch Gridley	1 5/8
	1 5/8-inch Acme Gridley	1 5/8
	No. 206 New Britain	1 5/8
	No. 415 New Britain	1 5/8
	No. 410 New Britain	.....
	1 3/4-inch Gridley	1 3/4
	1 3/4-inch Greenlee	1 3/4
	No. 4 Brown & Sharpe	1 7/8
	2-inch Greenlee	2
	2-inch Gridley	2
	2-inch Cleveland	2 1/2
	2" by 2 3/4" Cleveland.	3 1/4
	2 1/4-inch Cleveland	2 1/2
	2 1/4" by 2 3/4" Cleveland	3 1/4
	2 1/4-inch Gridley	2 1/4
	2 1/4-inch Greenlee	2 1/4
5	No. 6 Brown & Sharpe.	2 3/8
	No. 208 New Britain	2 1/2
	No. 425 New Britain	2 1/2
	2 5/8-inch Gridley	2 5/8
	2 3/4" by 3 3/4" Cleveland	3 1/4
	2 3/4" by 4" Cleveland.	2 3/4
	3-inch Gridley	3
	3 5/16-inch Gridley	3 5/16
6	3 1/4-inch Gridley	3 1/4
	3 1/2-inch Gridley	3 1/2
	4-inch Gridley	4
	4-inch Cleveland	4
	4 1/4-inch Cleveland	4 1/2
	4 1/4-inch Cleveland	4 1/4
	4 1/4-inch Gridley	4 1/4
	4 1/2-inch Gridley	4 1/2
	5-inch Gridley	5
	5 1/2-inch Cleveland	5 1/2
	6 3/4-inch Cleveland	6 3/4
	7 3/4-inch Cleveland	7 3/4

All dimensions are given in inches.
*The group classification numbers apply to all machine models of the respective makes listed having the maximum capacities indicated.

BROACH MAINTENANCE OPERATIONS

A RESHARPENING

Restoring cutting edges that have been dulled from normal use.

B RECONDITIONING

1. Along with normal resharpening, it is often necessary to "recondition" broaches for correct cutting action. That is, "gum out" between the teeth when sharpening has reduced chip clearance beyond working limits.

2. After several sharpenings, and even gumming out, it is sometimes economical to "re-sink" the entire form on form tools.

C SALVAGING

Broken broaches can often be returned to full production duty after salvaging operations. Broken shanks can be repaired by welding, broken teeth can be re-stepped in some cases, etc.

Another important phase of salvaging is the conversion of good broaches to do jobs other than that for which they were originally designed. If engineering or production changes prohibit the use of present broaching tools, perhaps they can be converted to do other operations.

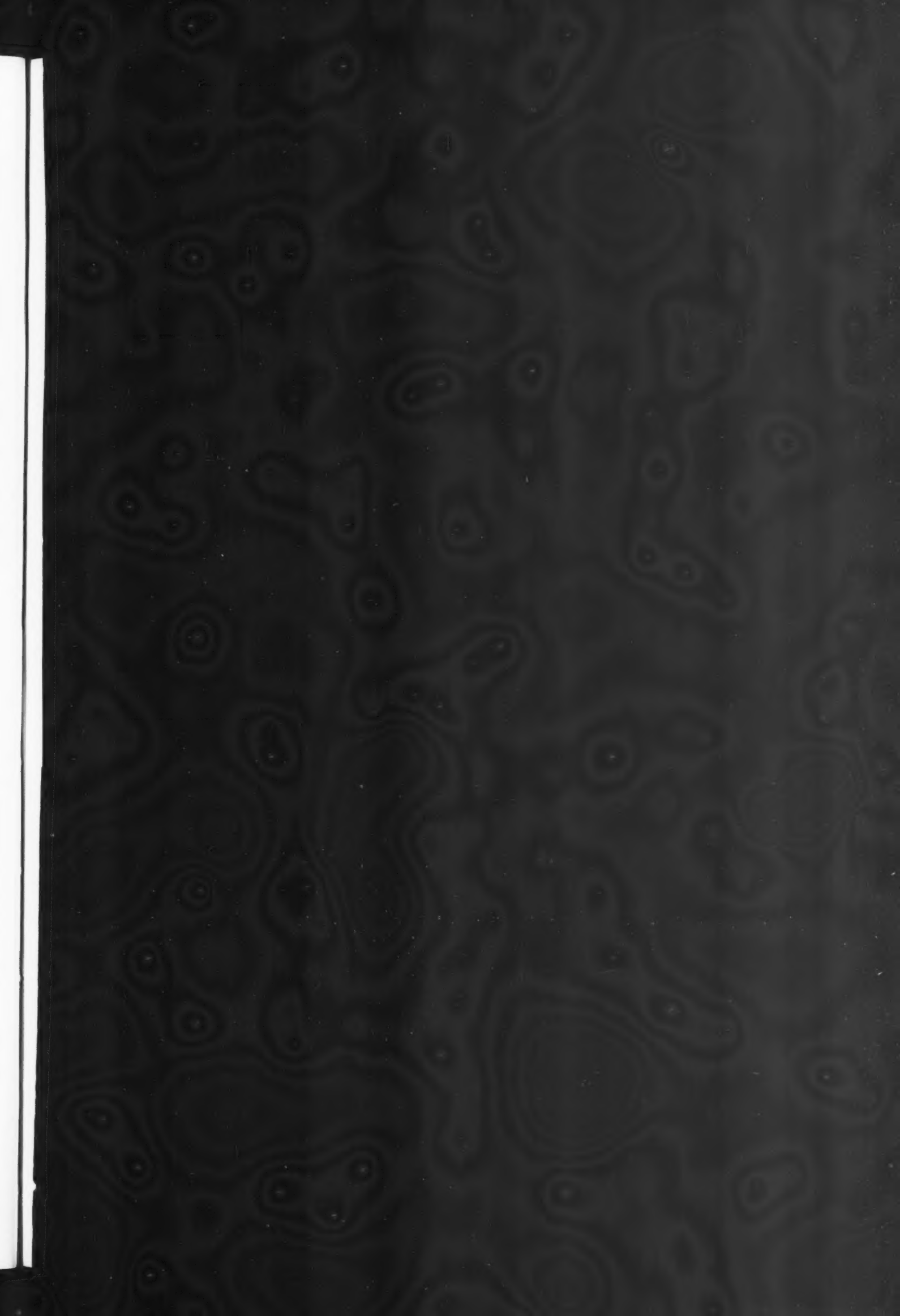
Ever since we designed and made the first set of broaches at Detroit Broach, we have welcomed broaches that were returned to us for maintenance, whether resharpening, reconditioning or salvaging was required. It is just as important to us to keep broaches "on the job" as it is to design, make and deliver new ones. There are advantages to you, too!

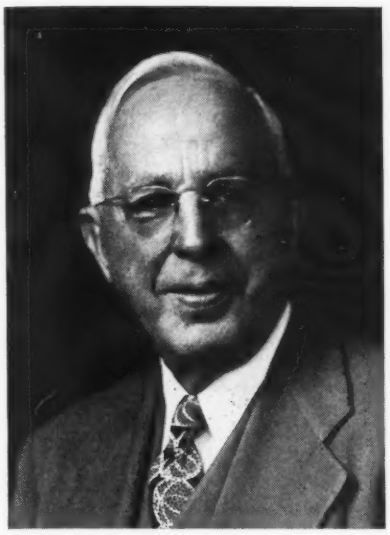
To perform any one of the three broach maintenance operations—they're defined at the left—requires proper equipment, inspection facilities and knowledge of broach design. Every broach returned to us should naturally be accompanied by instructions from the customer. In the light of these instructions it will be inspected by one of our engineers. He determines whether or not it is advisable to repair the tool—sometimes it is most economical not to—and if it is advisable, designates what operations are required. These operations are then performed on equipment selected for that purpose—by men skilled in broach maintenance. Finally, the broach is inspected on the finest and most complete broach inspection equipment available . . . following the same detailed inspection procedure used on new broaches.

Many of our customers have always taken advantage of this service because it has proven to save them money. We suggest that you do, too . . . to guarantee the ultimate in broaching production at lowest over-all tool cost.

DETROIT *Broach* COMPANY

20201 SHERWOOD AVE. DETROIT 12, MICH.





(Left) George W. Binns, Head of New Developments, Cincinnati Milling Machine Co. (Right) John B. Elfring, Manager of Production Control, Time Study, Planning, and Tool Design

Division; ALFRED T. BLACKBURN becomes general shop superintendent; GEORGE W. BINNS has been appointed head of new developments; JOHN B. ELFRING has been advanced from head of the tool design department to manager of production control, time study, planning, and tool design; HAROLD THOMAS has been promoted from assistant to head of tool design; and FRED MILLER has been advanced from supervisor of plant No. 2 to assistant general superintendent.

ROBERT HUTCHINSON has been appointed application engineer in the central district for Kennametal, Inc., Latrobe, Pa., manufacturer of cemented-carbide tools. Mr. Hutchinson's headquarters will be at 860 Hanna Bldg., Cleveland, Ohio.

GEORGE A. DANIELS has been appointed secretary and treasurer of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, succeeding W. C. BATCHELOR, who resigned on January 1, after thirty-three years of service.

JAMES W. MORAN has been elected president of the Baker-Raulang Co., Cleveland 13, Ohio, to succeed E. J. BARTLETT, who has been made president emeritus, and who will continue to serve as a director.

Pennsylvania

C. S. GOTWALS has been appointed quality manager of all the plants of S K F Industries, Inc., Philadelphia, Pa., manufacturers of ball and roller bearings. Mr. Gotwals was formerly superintendent of the main plant in Philadelphia, in which position he will be succeeded by CHARLES R. SCOTT, JR., who has been in charge of the Machining Division since 1946. W. F. SHEDINGER will direct operations of the Machining Division, in addition to filling his duties as head of the Ball Division.

J. C. FINK has been made manager of the industry engineering department of the Westinghouse Electric Corporation, Pittsburgh 30, Pa. He has been connected with the company since graduating from Pennsylvania State University in 1927, at which time he joined the Westinghouse Student Course.

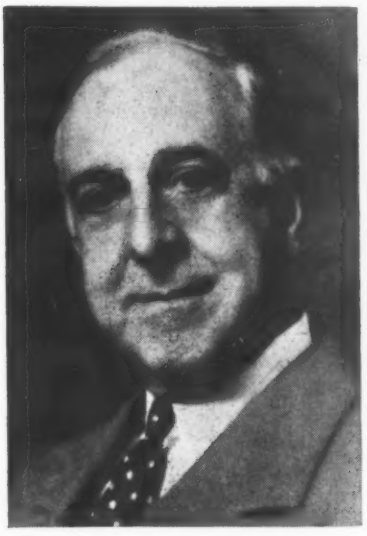
MICHAEL N. W. DE BERARDINIS has been appointed manager of sales promotion and advertising for the Firth Sterling Steel & Carbide Corporation, McKeesport, Pa. He was formerly with the sales promotion and advertising department of the Westinghouse Electric Corporation.

Michael N. W. de Berardinis, Manager of Sales Promotion and Advertising, Firth Sterling Steel & Carbide Corpn.

JAMES J. NELSON, formerly sales representative for the American Brake Shoe Co., 230 Park Ave., New York 17, N. Y., has been appointed eastern sales manager of the National Bearing Division, with headquarters in Meadville, Pa.

ROBERT M. ARNOLD, a director of the Allegheny Ludlum Steel Corporation, Pittsburgh 22, Pa., has been appointed a vice-president of the corporation.

FLOYD ROSE retired on December 31 as chairman of the board of directors of the Firth Sterling Steel & Carbide Corporation, McKeesport, Pa. Mr. Rose, who had occupied the post since October, 1945, will continue as an active member of the board.



Floyd Rose, who has Retired as Chairman of the Board of Firth Sterling Steel & Carbide Corporation

* * *

Industrial Engineering Film

An educational film entitled "Mighty Labors," treating of the subject of industrial and management engineering, has been produced by the Industrial Engineering College, 3309 W. Washington Blvd., Chicago 24, Ill. It is designed for executives, foremen, key employes, and high school groups. Those interested in showing the film can obtain further data from the Industrial Engineering College at the address given above.

Obituaries

Charles H. Gallmeyer

Charles Henry Gallmeyer, president of the Gallmeyer & Livingston Co., Grand Rapids, Mich., manufacturer of machine tools, died on December 31 at his home in Grand Rapids after a long illness. He was sixty-eight years of age.

Mr. Gallmeyer was born in Grand Haven in 1880, and obtained his early education in that city. Later his family moved to Grand Rapids where he graduated from the Central High School in 1899. Following his graduation from high school, he started his business career as a clerk with R. G. Dun & Co. of Grand Rapids.

In 1908, he engaged in the wholesale lumber business as a partner in the firm of Davidson-Gallmeyer Lumber Co. of Toledo, Ohio, and four years later sold his interest in that company and returned to Grand Rapids as treasurer of the Valley City Machine Works. In 1923, this firm merged with the Grand Rapids Grinding Machine Co. and the Union Machine Co. to form the Gallmeyer & Livingston Co. of which Mr. Gallmeyer was first named treasurer, subsequently becoming president.

Mr. Gallmeyer was a prominent citizen in the community in which he lived, and was a member of various fraternal organizations. His passing will be deeply felt by the members of the organization that he headed and by his other friends in the industry. He is survived by his wife and a daughter.

CHARLES CAMERON CARR, for forty-four years associated with the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, died at his home in Cincinnati on January 8, following a long illness, at the age of sixty-six years. Mr. Carr was recognized throughout the world as one of the leading authorities on gun boring and rifling lathes. He started at the LeBlond plant as a lathe operator in 1905, working his way up to foreman in 1919. Later he joined the sales department as a field engineer, and represented the firm for over twenty-five years, travelling both in this country and abroad. During the last war, he specified equipment and estimated time required to produce Army howitzers and Navy rifles.

Coming Events

FEBRUARY 28 — MARCH 4 — Spring meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Hotel Edgewater Beach, Chicago, Ill. For further information, address the Society at its headquarters, 1916 Race St., Philadelphia, Pa.

MARCH 3-5 — Fifth annual conference of the AMERICAN SOCIETY OF TRAINING DIRECTORS at the Hotel Carter, Cleveland, Ohio. Chairman of the Publicity Committee, L. W. Morgan, Care of the Yoder Co., 5500 Walworth, Cleveland, Ohio.

MARCH 8-10—Passenger Car, Body, and Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

MARCH 10-12—Seventeenth annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS at the Hotel William Penn in Pittsburgh, Pa. Executive secretary, Harry E. Conrad, 1666 Penobscott Bldg., Detroit 26, Mich.

MARCH 14-17—SEVENTH PRODUCTION SHOW sponsored by CHICAGO TECHNICAL SOCIETIES COUNCIL at the Stevens Hotel, Chicago, Ill. For further information, address Edward C. Bowman, general manager, 8 S. Michigan Ave., Chicago 3, Ill.

MARCH 28-30—Transportation Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Statler Hotel in Cleveland, Ohio. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

APRIL 8-22 — GERMAN INDUSTRIAL EXHIBIT to be held at the Museum of Science and Industry, 30 Rockefeller Plaza, New York City. Exhibit sponsored and arranged by the Joint Export and Import Agency in Frankfort, Germany.

APRIL 11-12—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS' CONFERENCE ON THE INDUSTRIAL APPLICATION OF ELECTRON TUBES in the Statler Hotel, Buffalo, N. Y. Headquarters of the Society, 33 W. 39th St., New York 18, N. Y.

APRIL 11-13 — Fourth annual convention and Lubrication Show of the AMERICAN SOCIETY OF LUBRICATION ENGINEERS at the Hotel Statler (formerly Pennsylvania), New York City. Secretary, W. F. Leonard, 343 S. Dearborn St., Chicago 4, Ill.

APRIL 11-13 — Aeronautic and Air Transport Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel New Yorker in New York City. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

APRIL 11-16—SIXTH WESTERN METAL CONGRESS AND EXPOSITION at the Shrine Auditorium, Los Angeles, Calif. For further information, address National Secretary of American Society for Metals, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

APRIL 25-28 — FOURTH SOUTHERN MACHINERY AND METALS EXPOSITION in the Atlanta Municipal Auditorium, Atlanta, Ga. Michael F. Wiedl, managing director, 267 E. Paces Ferry Road, N.E. Atlanta, Ga.

MAY 10-13 — Eighteenth annual NATIONAL PACKAGING EXPOSITION in the Public Auditorium, Atlantic City, N. J. Sponsored by the American Management Association, 330 W. 42nd St., New York 18, N. Y.

MAY 19-21—Spring meeting of the SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS at the Hotel Statler, Detroit, Mich. For further information, address the Society, P. O. Box 168, Cambridge 39, Mass.

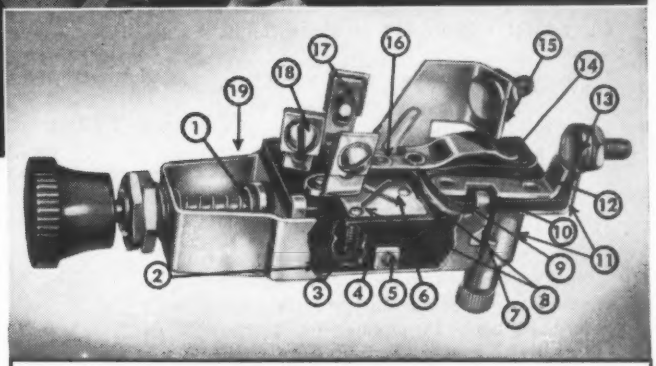
JUNE 27-30 — Thirty-Sixth Annual Convention of the AMERICAN ELECTROPLATERS SOCIETY in Milwaukee, Wis., with headquarters at the Schroeder Hotel. For further information, address the Society at 473 York Road, Jenkintown, Pa.

JUNE 27-JULY 1—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Hotel Chalfonte-Haddon Hall, Atlantic City, N. J. Headquarters of the Society, 1916 Race St., Philadelphia 3, Pa.

OCTOBER 10-14 — National meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS in San Francisco, Calif.; headquarters, Fairmont Hotel. For further information, address the Society at 1916 Race St., Philadelphia 3, Pa.

REVERE MATERIALS + COLE-HERSEE DESIGN ASSURE DEPENDABLE HEADLAMP OPERATION

(Sixty Percent of All Automobile Accidents Occur After Dark)



Three-Position Heavy Duty Headlamp Switch, made by Cole-Hersee Company, 20 Old Colony Ave., Boston 27, Mass.

1. Spring Backed Dustproofed Gland
2. Heavy Steel Case and Bracket
3. Four Separate Contact Springs
4. Moulded Bakelite Contact Carrier
5. Double Independent Action
*6. Heavy Gauge Phosphor Bronze Contactor
7. Interlocking Back Prevents Short Circuiting
*8. Silver Inlaid Phosphor Bronze Contacts
9. Canvas Base Bakelite
10. Six Clinching Ears
11. One Piece "Hot Wire" Conductor
12. Heavy Reinforcement and Thrust Stop
*13. Terminal Studs Welded to Conductors
*14. Heavy Gauge Phosphor Bronze Spring Contacts
15. Heavy Conductor and Thrust Stop
*16. Silver Inlaid Phosphor Bronze Contact Rivets
17. Heavy Gauge Screw Terminals
18. Shakeproof Lockwashers With Locking Tail
19. Bracket Extension To Clear Dash Obstructions

**Parts starred are made of Revere Metals*

HERE is a picture and sectional view of a device frequently used by motorists, who know nothing about it except that it has a knob and works perfectly when pushed or pulled. It is a Cole-Hersee three-position light switch: Off, Parking Lights, Headlights.

Because such a switch is so reliable and long-lived, one might suppose it to be simple. It is far from that. Its operation, however, is simple, and is protected by design and materials which foresee the conditions and contingencies of use.

Note the variety of the materials. They include steel in several types and forms, brass, phosphor bronze, canvas base bakelite, a felt washer to exclude dust, plastic, and if you include the fuse, lead and glass. In the list of features the four items starred are made of Revere Metals.

This is an excellent example of the manner in which wise manufacturers employ Revere Metals. Both they and we realize that every metal and material has its individual qualities and applications. When these are understood and chosen with full regard for conditions of fabrication and use, a fine product has been given its fundamental guarantee. It is one of the important duties of Revere Technical Advisors to collaborate in the selection of the many different Revere Metals. If you would like to obtain the benefits of this service, get in touch with the nearest Revere Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.

New Books and Publications

DESIGN FOR WELDING. 1000 pages, 5 1/2 by 7 1/2 inches. Published by the James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio. Price, $2, postpaid, in the United States; $2.50 elsewhere.

A significant record of the progress of arc-welding throughout industry during the post-war years is contained in this new book. It is composed of abstracts of eighty-two award papers in the recent Lincoln Foundation "Design for Progress" Award Program. The papers were selected and edited by Professor R. S. Greene, acting chairman of the department of welding engineering of Ohio State University, Columbus, Ohio.

The book has been prepared with the purpose of making available a record of representative welded designs, emphasis being placed on projects produced and in operation. There is a liberal presentation of cost data on the various designs, which affords a means of making a comparative study of methods. The papers included in the book are classed in the following categories: Aircraft; automotive; railroad; watercraft; containers; furniture; structures; machinery; and welderies. The sections on machinery and structures are outstanding, and the quality of the papers evidences the advance in design in these fields.

MACHINE DESIGN. By Paul H. Black, Professor of Machine Design, Cornell University. 357 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $4.

This book is intended to serve as a basic text-book for college courses in general machine design and as a reference book in mechanical-design offices. The material covers strength and deflection considerations; stress concentration; selection of materials; machine elements such as fastenings, springs, and translation screws; methods of designing and selecting power transmission units and their components; gear design; surface, finish and wear; and vibration control. There is an appendix containing typical problems in machine design to be worked out by the student.

MOTION AND TIME STUDY. By Ralph M. Barnes. 559 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $5.

To insure that the latest and most successful motion and time study techniques are included in this book, the author conducted a survey of eighty factories throughout the country and incorporated the findings of this survey in the third edition of this book, which has just been published. The material in the previous editions has been completely revised and five new chapters on process analysis, gang process charts, activity charts, and man and machine charts have been added. Two appendixes tell how to set up a work methods training program.

FBI REGISTER OF BRITISH MANUFACTURERS (1948-1949). 752 pages, 9 1/2 by 7 1/8 inches. Published for the Federation of British Industries by Kelly's Directories, Ltd. and Iliffe & Sons, Ltd., Dorset House, Stamford St., London, S.E. 1, England. Price, 42 shillings plus postage.

This directory, which is now in its twenty-first edition, lists the members of the Federation of British Industries, which includes nearly 6000 British manufacturers. It has a classified products and services section containing more than 5000 headings, which facilitates the rapid identification of supply sources. In addition, there is a section containing the complete addresses of all FBI members, with their telephone numbers, telegraphic addresses, overseas agents, and other information useful to buyers. Two sections listing trade names and trademarks enable the names of manufacturers of various trademarked products to be readily located. The register is arranged throughout for easy and quick reference. Although printed in English, information on how to use the book is given in French and Spanish for non-English speakers.

* * *

Oakite Celebrates Fortieth Anniversary

Oakite Products, Inc., New York City, celebrates its fortieth anniversary this month. The company was founded on February 2, 1909, to manufacture industrial cleaning materials and to cooperate with industry on production and maintenance cleaning procedures. In order to provide assistance to customers and assure the most effective application of its cleaning materials, a nation-wide field service organization of 180 technical representatives has been established. Starting with a production of but one chemical cleaning material, the business has expanded until, today, more than eighty cleaning compounds are being produced for use in the metal and machinery field, as well as other branches of industry.

Industry to Assist Iron and Steel Scrap Drive

The Department of Commerce, in cooperation with other Federal agencies and industry, is sponsoring a nation-wide iron and steel heavy scrap drive to help increase the production of steel and castings for which heavy scrap, now in short supply, is the chief raw material. A Scrap Drive Committee composed of seventy trade association executives was appointed by the Secretary of Commerce to assist the Office of Industry Cooperation.

The committee is concentrating on obtaining heavy scrap in the form of obsolete dies, jigs, tools, fixtures, and other machinery. Steel and iron facilities are being expanded, so that if sufficient heavy scrap is made available as a result of this drive, an estimated 92,000,000 net tons can be produced in 1949, according to the American Iron and Steel Institute, as compared with the high rate in 1948 of 88,500,000 net tons. That rate was not sufficient, however, to meet the current demands of our domestic economy, military requirements, and the foreign aid program.

* * *

New Yale & Towne Materials-Handling Equipment Plant

To increase its facilities for the production of materials - handling equipment, the Yale & Towne Mfg. Co. recently moved its Philadelphia Division to a new plant at Roosevelt Blvd., opposite Northeast Airport, located on a 93-acre tract. The new plant was designed around the company's own production methods and system of handling material. It has a 775,000 square-foot floor space.

Besides the company's regular line of equipment, which includes hoists, hand and electric trucks, and industrial dial scales, production in the new plant will include a line of gasoline-engine industrial trucks known as the "Lift King." This line will feature fluid drive, automotive controls, hydraulic piston lift, and low mast heights, with high free lifts.

* * *

At the annual meeting of the Resistance Welder Manufacturers' Association in Detroit, the following officers were elected: President, B. L. Wise, director of production, National Electric Welding Machines Co., Bay City, Mich.; chairman of the executive committee, T. S. Long, vice-president and general manager of the Taylor-Winfield Corporation, Warren, Ohio; and vice-president, T. Embury Jones, president of Precision Welder & Machine Co., Cincinnati, Ohio.

ENGINEERING
LIBRARY

FEBRUARY 1949 — FIFTY-FIFTH YEAR

FEB 14 1949

MACHINERY

First IN DRAFTING MACHINES

BOARDMASTER

by UNIVERSAL DRAFTING MACHINE COMPANY, CLEVELAND

Compressor Blocks Now Finished

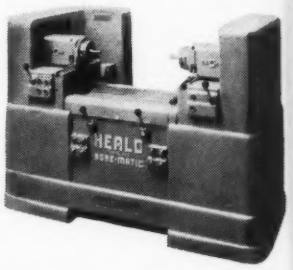
20% FASTER, and with HIGHER PRECISION

on a new Heald Model 222 Bore-Matic

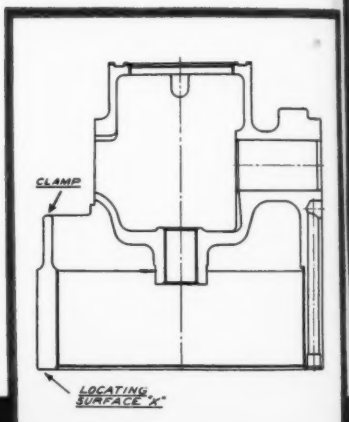
Here's a typical case where a new Heald machine meant more and better production at lower cost.

With this Heald Model 222 Bore-Matic, a manufacturer of compressor bodies has "upped" production 20%, improved product quality, and increased operator efficiency. Parts are now bored, faced and chamfered, two at a time, in a single automatic machine cycle. Faster indexing for greater cycle speed, constant feed hydraulic control for greater precision, and simplified loading and handling have made these savings possible.

Such results don't "just happen." They are the end product of years of research and engineering to produce a new line of Bore-Matics as well as Internal and Rotary Surface Grinders, which are especially designed for your present-day needs. So, whatever your precision finishing problems, why not get in touch with your nearest Heald representative. His job is to help you do your job better, and at lower cost.



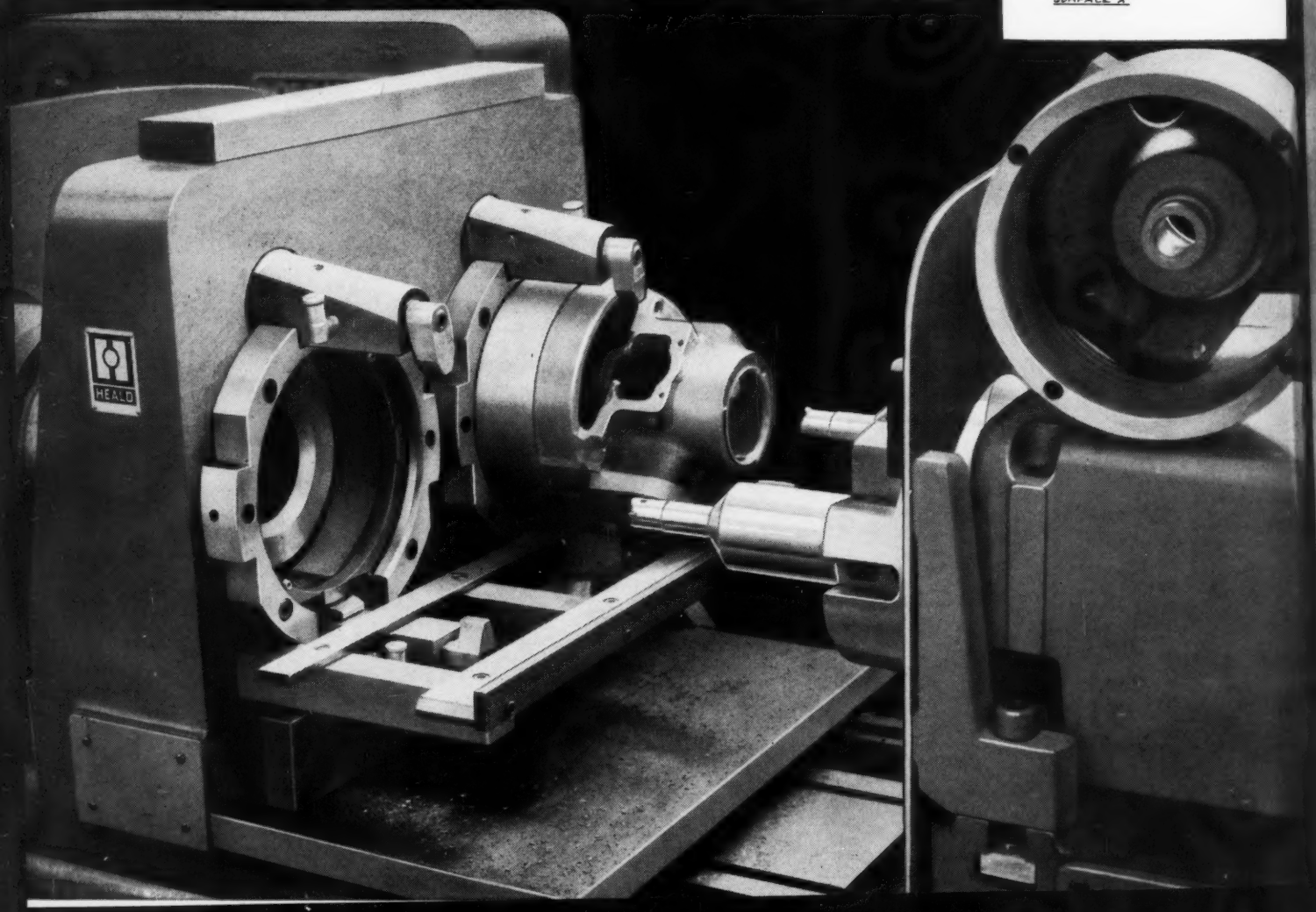
Increased production of compressor blocks is due to a faster operating, easier loading new Heald Model 222 Bore-Matic. Drawing below shows surfaces borized.



THE HEALD MACHINE COMPANY

Worcester 6, Mass.

Branch Offices in Chicago • Cleveland • Dayton
Detroit • Indianapolis • Lansing • New York



V 729.8

1. LANDIS DIE HEADS cut tool cost by using chasers that are independent units. Worn or damaged chasers are reground or replaced individually, without affecting the remaining chasers of the set.

2. LANDIS DIE HEADS reduce tool inventories by cutting both right- and left-hand threads with a single set of chasers. Chasers are ground on both ends, the spring action in the die head is reversed, and either a right-hand or left-hand set of chaser holders is used.

3. LANDIS DIE HEADS cut all diameter threads with a constant pitch and form within the rated range of the die head with a single set of chasers. Short thread lengths larger than the rated diametrical range can be cut with the same die head equipped with over-size chaser holders.

4. LANDIS DIE HEADS use chasers that can be reground to 80% of their length. Regrinding is a simple operation restoring the entire cutting edge and leading feature, yet retaining the initial accuracy of pitch, diameter, and depth of cut.

5. LANDIS DIE HEADS improve thread finish and cut production costs by reducing chaser wear and breakage. The tangential position of the chaser to the work allows lateral absorption of cutting strains. Resulting reduced friction and vibration make higher cutting speeds possible without causing thread distortion or chaser breakage.

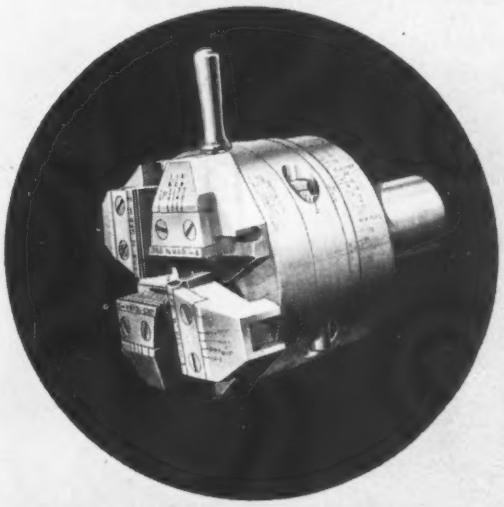
6. LANDIS DIE HEADS consistently produce threads accurate for lead. Regrinding does not destroy the lead controlling feature of the chasers. Thus this feature assures accurate pitch threads throughout the chaser's life.

7. LANDIS DIE HEADS are built to stay on the production line. Tough, high-carbon steel is used in all parts. Rigid construction maintains accuracy, and minimizes wear of working parts. Landis Die Heads are furnished in two models, heat-treated or hardened-and-ground, depending on the application and quality of thread desired.

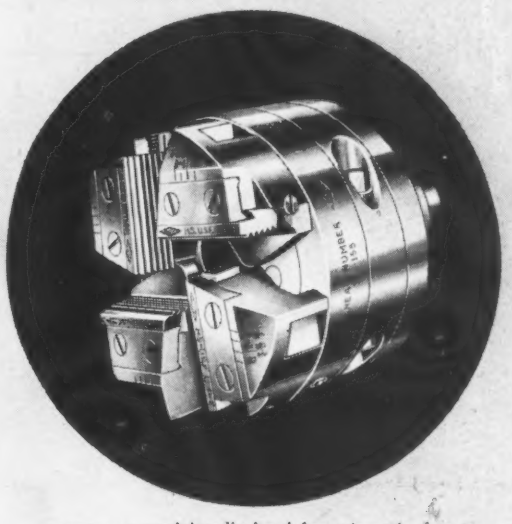
LANDIS Machine COMPANY

WAYNESBORO · PENNSYLVANIA

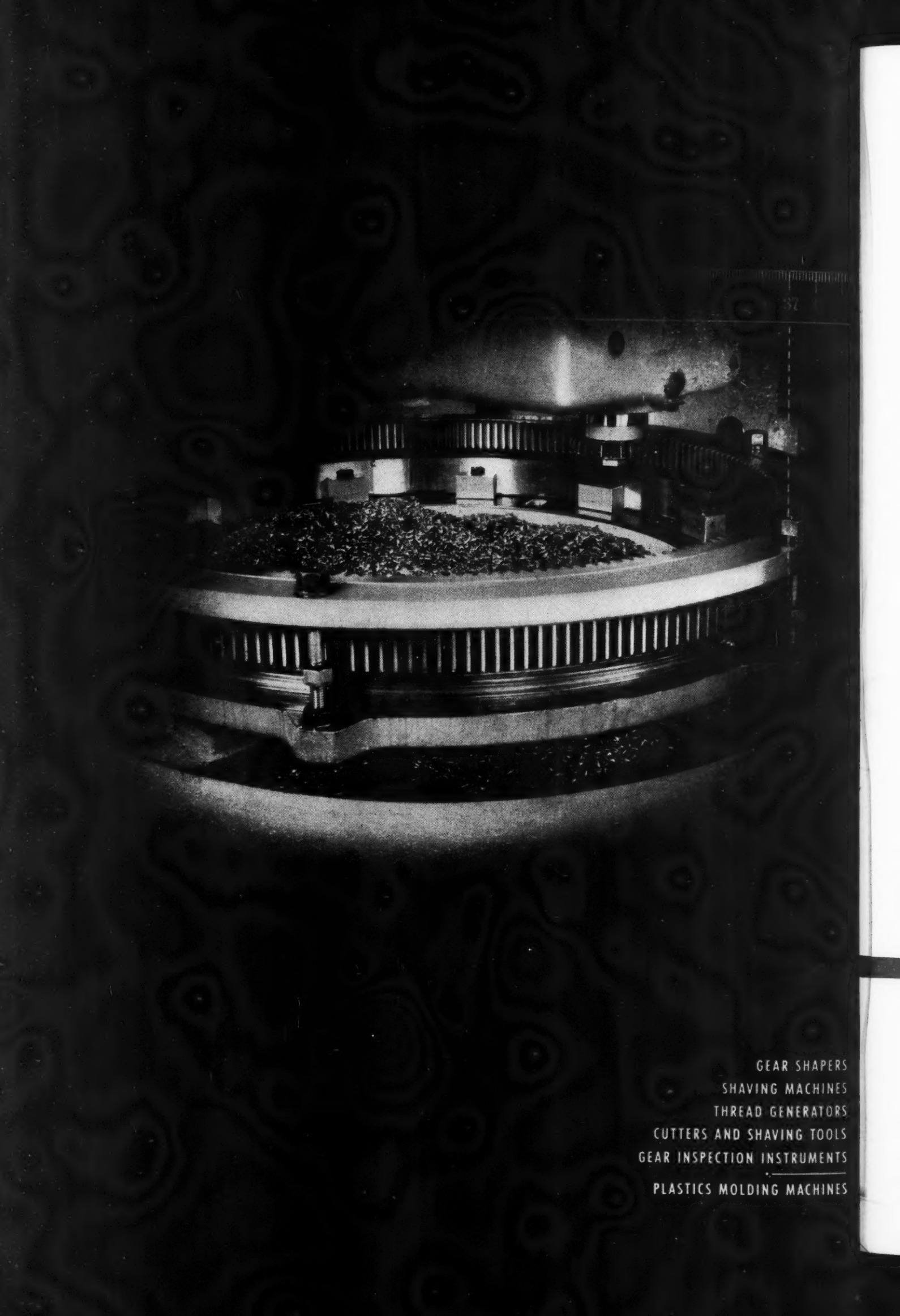
LANCO—a revolving die head for hand-operated semi-automatic, and automatic threading machines.



LANDMATIC—a stationary die head for turret lathes.



LANDEX—a revolving die head for automatic screw and other "live spindle" machines.



GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS

PLASTICS MOLDING MACHINES

New Mastery of Costs on BIG GEARS

Here is a new Fellows machine . . . the 36-inch Gear Shaper . . . the rigid construction of which permits the taking of heavier cuts that set a new production pace, and a new and lower standard of costs in gear cutting.

A case in point is the large combined external and internal gear illustrated. Feeds as high as .0225" per stroke at 58 strokes per minute prove the ability of this machine to take fast, heavy, roughing cuts. A study of the tabulation below should whet the interest of those seeking to lower their costs in gear cutting.

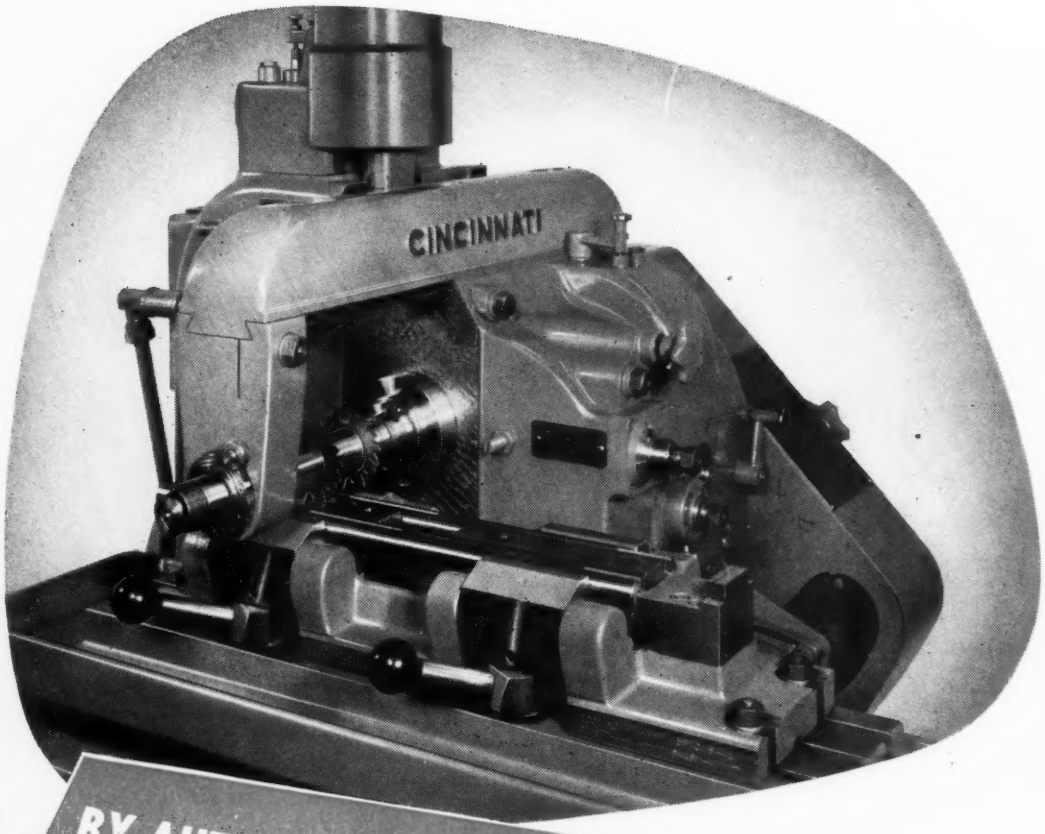
	External Gear	Internal Gear
Material	SAE 3250 52 R-C	SAE 3250 52 R-C
Pitch diameter (inches)	37.166	34.666
No. of teeth	223	208
Diametral pitch	6	6
Pressure angle	20°	20°
Face width (inches)	2¼	1¾
Roughing cut (58 strokes per min.)	.0225" per stroke	.0225" per stroke
Finish cut (58 strokes per min.)	.027" per stroke	.027" per stroke (86 STROKES PER MINUTE)
TOTAL PRODUCTION TIME	2 hrs. 48 min. 45 sec.	2 hrs. 15 min.

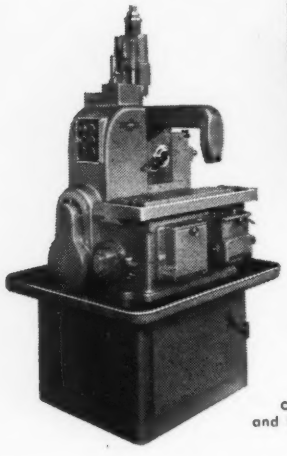
We have even more data to offer in evidence of the remarkable production possibilities of the 36-inch Gear Shaper. Call or write our nearest office.

Fellows

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department • 78 River Street, Springfield, Vermont.
Branch Offices: 616 Fisher Bldg., Detroit 2 • 640 West Town Office Bldg., Chicago 12 • 7706 Empire State Bldg., New York 1.

IT SAVES TIME





CINCINNATI No. 0-8 Automatic Rise and Fall Milling Machine. Catalog M-1607.

BY AUTOMATICALLY JUMPING OBSTRUCTIONS

Drawing of the part, and diagram of the automatic cycle employed in milling two short keyways in one setting.

CYCLE

Lower carrier	Lower carrier
Feed table right	Feed table right
Raise carrier	Raise carrier
Rapid advance table right	Rapid return table left
Feed table right to accurate location	Stop

PRODUCTION DATA

Part name	Shaft
Material	SAE 1112 steel
Operation	Mill two keyways
Spindle speed	117 rpm
Table feed	10 in./min.
Production	104 per hour
Equipment	CINCINNATI No. 0-8 Rise and Fall Milling Machine equipped by Cincinnati Application Engineers

● Grade school boys always take the shortest distance between two points . . . race over lawns, jump over hedges, climb over or under fences. For them it's so much easier. The same dexterity can be employed to advantage in many milling operations. CINCINNATI No. 0-8 Automatic Rise and Fall Milling Machines supply the dexterity by jumping over obstructions in the way of milled surfaces; save time by combining operations. ¶ The illustration above shows how this timesaving automatic feature—mill, jump over space, mill—is employed in milling two short keyways in a shaft. To reduce the cost still further, Cincinnati Application Engineers designed the fixture to hold two parts. Inexpensive "cycle selectors" (they can be interchanged in less than a minute) coordinate the longitudinal and vertical traverse movements. ¶ CINCINNATI No. 0-8 Rise and Falls can be employed in other ways, too: for conventional straightaway milling cuts, *to retract the cutter on the return stroke and save the finish.* Catalog M-1607 gives additional data. Brief specifications in Sweet's Catalog File for Mechanical Industries.

CINCINNATI

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

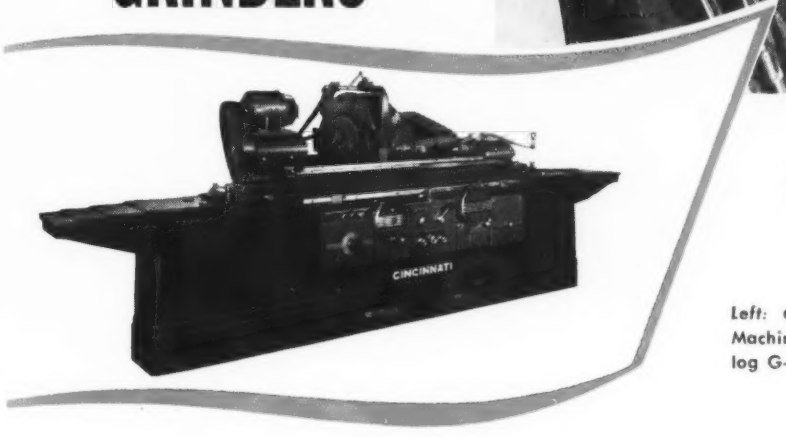
MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES
FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

You can assign the *tough jobs* to CINCINNATI

FILMATIC

GRINDERS

Above: Grinding milling machine arbors, after the keywaying operation. The machine is a CINCINNATI FILMATIC 10" Plain Hydraulic.



Left: CINCINNATI FILMATIC 10" Plain Hydraulic Grinding Machine, catalog G-490-2. Also available in 14" L size, catalog G-533-1. Between-center lengths 18", 36", 48" and 96".

An intermittent diameter is not the easiest job in the world to grind, especially when the parts are slender. It takes a good man, *and* a good machine. Here's a helpful tip in grinding work of this type. Cut a number of rectangular wood strips of a size to fit tightly into the keyway. The length should exceed the width of shoe on the backrest. Drive the wood filler into the keyway at each backrest contact. Use a fairly hard wood, such as maple. This precaution will greatly aid in sizing the work; it will prevent the backrest shoes from being "chewed up." And here's another helpful tip . . . grind jobs of this type on CINCINNATI FILMATIC Grinders. These machines have many features of value in precision grinding any type of work within their range: FILMATIC grinding wheel spindle bearings; smooth gearless headstock drive with infinitely variable speeds over 4 to 1 ratio; infinitely variable table traverse rates 3" to 220" per minute; headstock rotation and coolant flow automatically start and stop with the table traverse, and many other features which contribute to low cost precision grinding. You may obtain complete data by writing for publication G-490-2.

CINCINNATI

CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

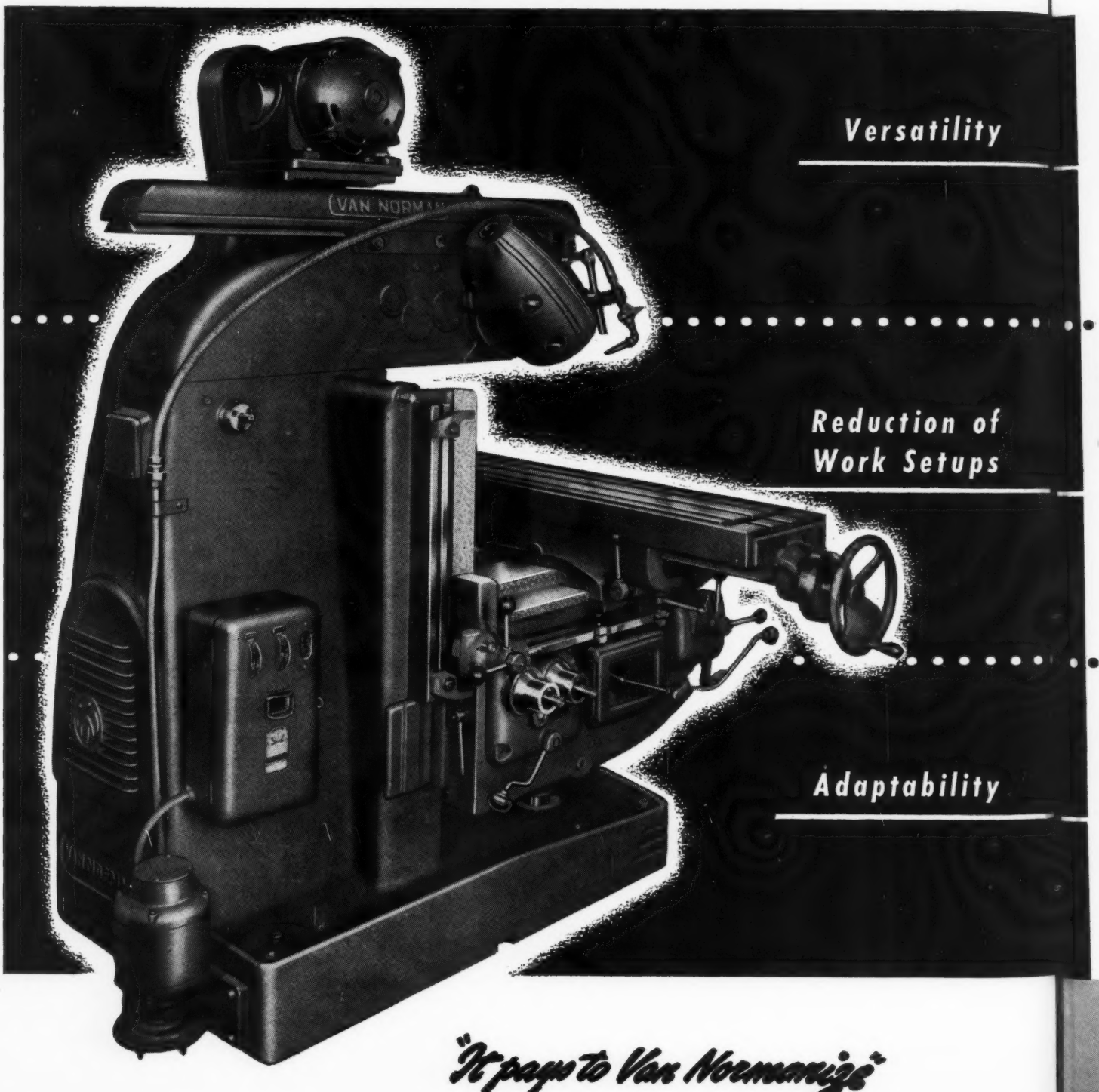
CENTER TYPE GRINDING MACHINES • CENTERLESS LAPPING MACHINES • CENTERLESS GRINDING MACHINES

For WORKABILITY

It's VAN NORMAN No. 36 Ram Type Miller

• Saves Setups • Cuts Idle Machine Time

• Increases Production



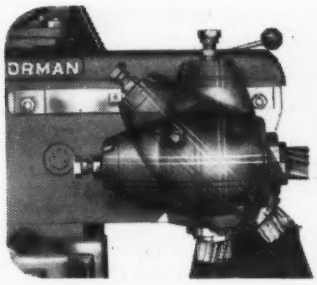
"It pays to Van Normanize"

The versatility of the Van Norman ram-type milling machine provides a greater work range than available on single purpose machines.

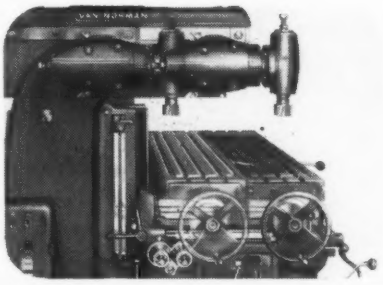
The adjustable cutterhead in combination with the movable ram enables you to perform conventional horizontal and vertical as well as angular milling. This feature cuts setup time by as much as 50%... increases productivity proportionately. In addition, front and rear directional controls of power feeds simplify operations . . . cut operator fatigue.

The Van Norman No. 36 Miller is ideal for use in the tool room, job shop, pattern shop, experimental laboratory, die and mold shop and for production work.

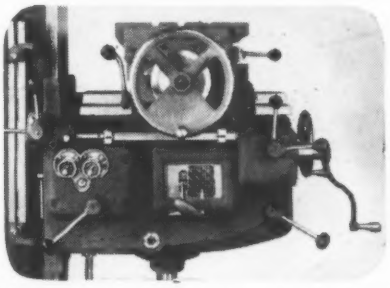
Write for illustrated bulletin, today.



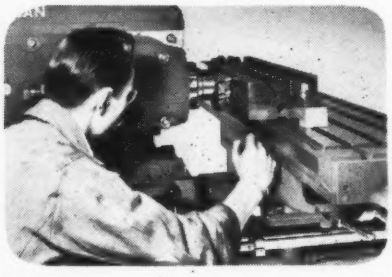
Adjustable cutterhead permits vertical, horizontal or angular milling on one miller. Its versatility is equal to three single-purpose machines.



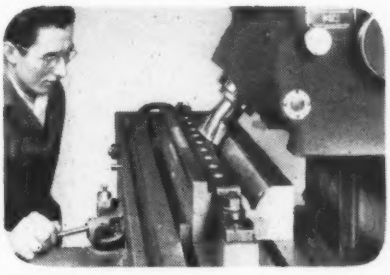
Adjustable cutterhead and movable ram in combination with the saddle crossfeed provide maximum milling capacity and versatility.



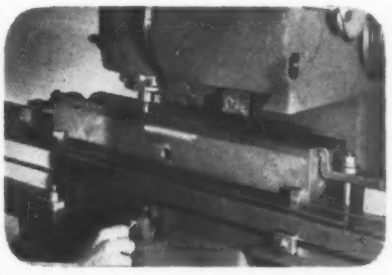
Front and rear directional control of hand and power feeds give complete visibility and control of operations from either location. Reduces worker fatigue . . . improves work accuracy.



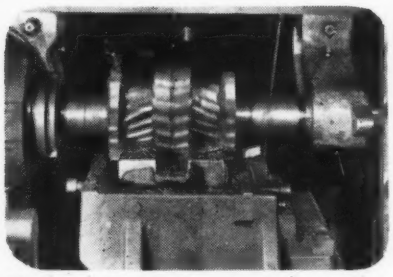
Horizontal milling—with cutterhead locked in horizontal position, operator uses rear directional controls and starts with a face milling operation.



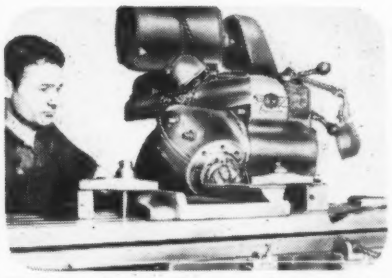
Angular milling—Here a V is being milled. Note that only the position of the cutterhead has been changed; workpiece is still in original position.



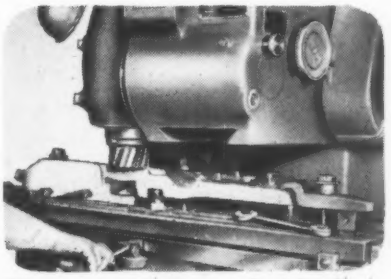
Vertical milling—Operator completes job with recess milling operation, using front directional controls. One work setup with simple cutterhead position changes completes most jobs.



Horizontal setup for boring and facing operation. The ram-type overarm with dovetail ways and outer support assures rigidity and accuracy.



With head locked in angular position the operator is taking an angular cut and operates the miller with the rear directional controls.



The ram-type miller used with adjustable cutterhead in the vertical milling position . . . operator using front directional controls.

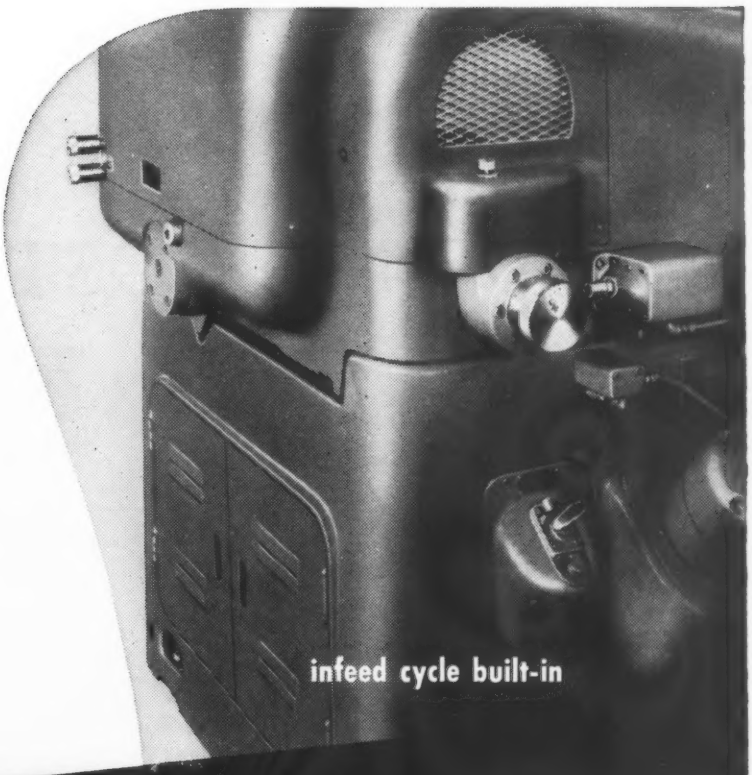
VAN NORMAN COMPANY

Springfield 7 Massachusetts

No. 12 Centerless Grinder equipped with automatic infeed cycle and air operated work ejector. Catalog T47 describes basic machine.

LANDIS TOOL *Precision Grinders*

If you have an infeed grinding problem or other precision grinding problem, production estimates and tooling suggestions will be made on the basis of your blueprints.



infeed cycle built-in

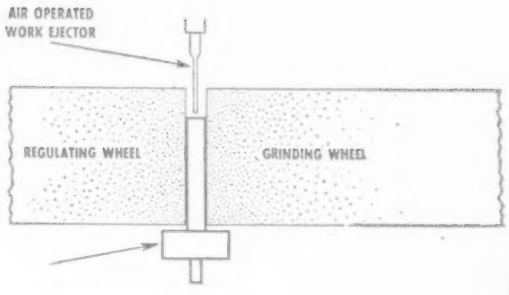
LANDIS TOOL

No. 12 centerless grinder features

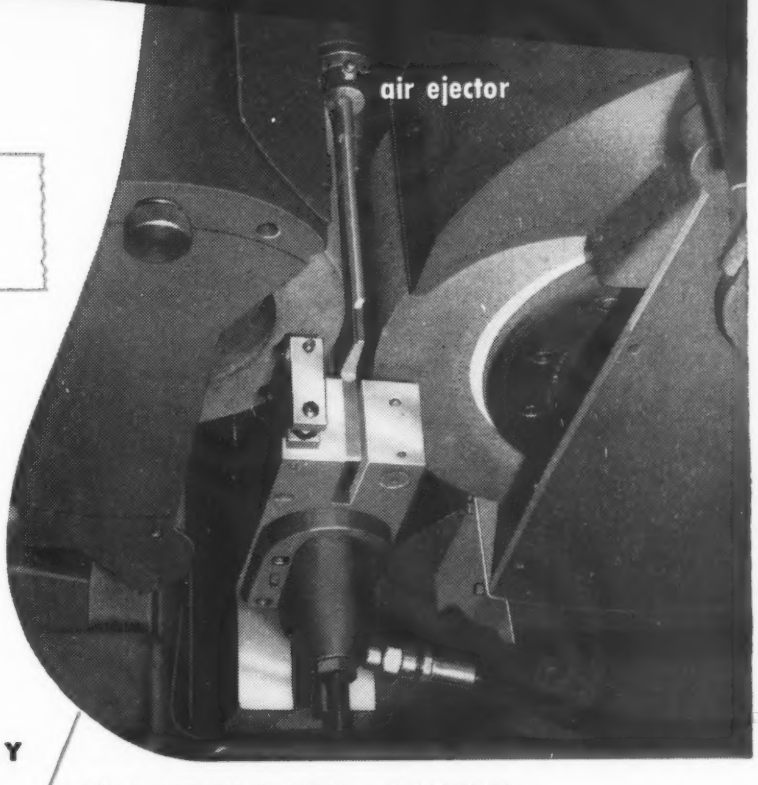
Microsphere spindle bearings for both wheel spindles.
V Belt drives
Hydraulically operated wheel dressers
Work rest solidly mounted on bed
Electrically controlled variable speed regulating wheel drive

LANDIS TOOL "PACE SETTER" Automatic Cycle

Makes Centerless Infeed Grinding More Productive



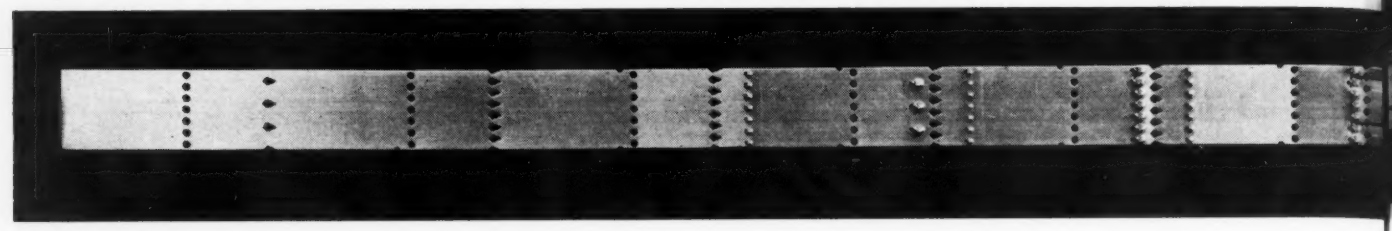
typical work set-up

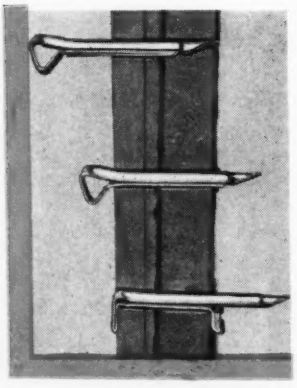


air ejector

LANDIS TOOL COMPANY
10 E. SIXTH ST. / WAYNESBORO, PENNA.

CUTTING COSTS FOR HOME





Today, as probably never before, ways and means are being investigated to reduce home building costs.

The Elastic Stop Nut Corporation of America, Union, New Jersey, has developed a self-clinching shingle nail, known as an Es-nail which provides a simple means of "locking" wood or asbestos shingles directly to gypsum or composition sheathing. The Es-nail can be driven with a regular shingling hatchet at any convenient point—there is no need to locate studs. The photograph (left) illustrates how the Es-nail "locks" shingles directly to gypsum sheathing.

The use of the Es-nail enables the builder to take advantage of the inherent economies of gypsum and insulation sheathing: lower unit cost; faster application; less waste. Recently a prominent New Jersey development company built two houses: one with conventional sidewalls, shingling over wood sheathing; the other was built the Es-nail way, applying shingles directly over gypsum sheathing. The savings from the use of Es-nails and gypsum sheathing amounted to $64.02 per 1,000 sq. ft.

Inasmuch as the Es-nails are used in large quantities the Elastic Stop Nut Corporation required equipment to produce the nails economically and at a high rate of speed. The U. S. Multi Slide Machine was selected on the basis of past performance in the production of precision stampings from material in coils.

The strip of material illustrated at the top of the page indicates the sequence of operations in the fabrication of the Es-nail in the No. 35 U. S. Multi Slide Machine. Note that seven complete nails are produced at each stroke of the machine from material of the exact width required for seven nails – a total gross production of 875 Es-nails per minute with no waste material to be trimmed away on the sides.

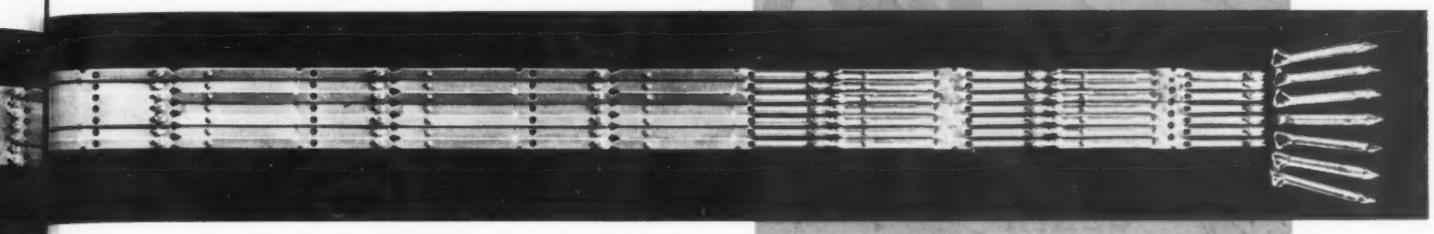
The No. 35 U. S. Multi Slide is one of the five standard sizes which we are now building—Bulletin No. 15 contains complete specifications. Ask for a copy and investigate their use for production of your precision stampings.

U. S. TOOL COMPANY, INC., AMPERE,

BUILDERS OF U. S. MULTI SLIDES — U. S. MULTI MILLERS — U. S. AUTOMATIC PRESS ROOM EQUIPMENT

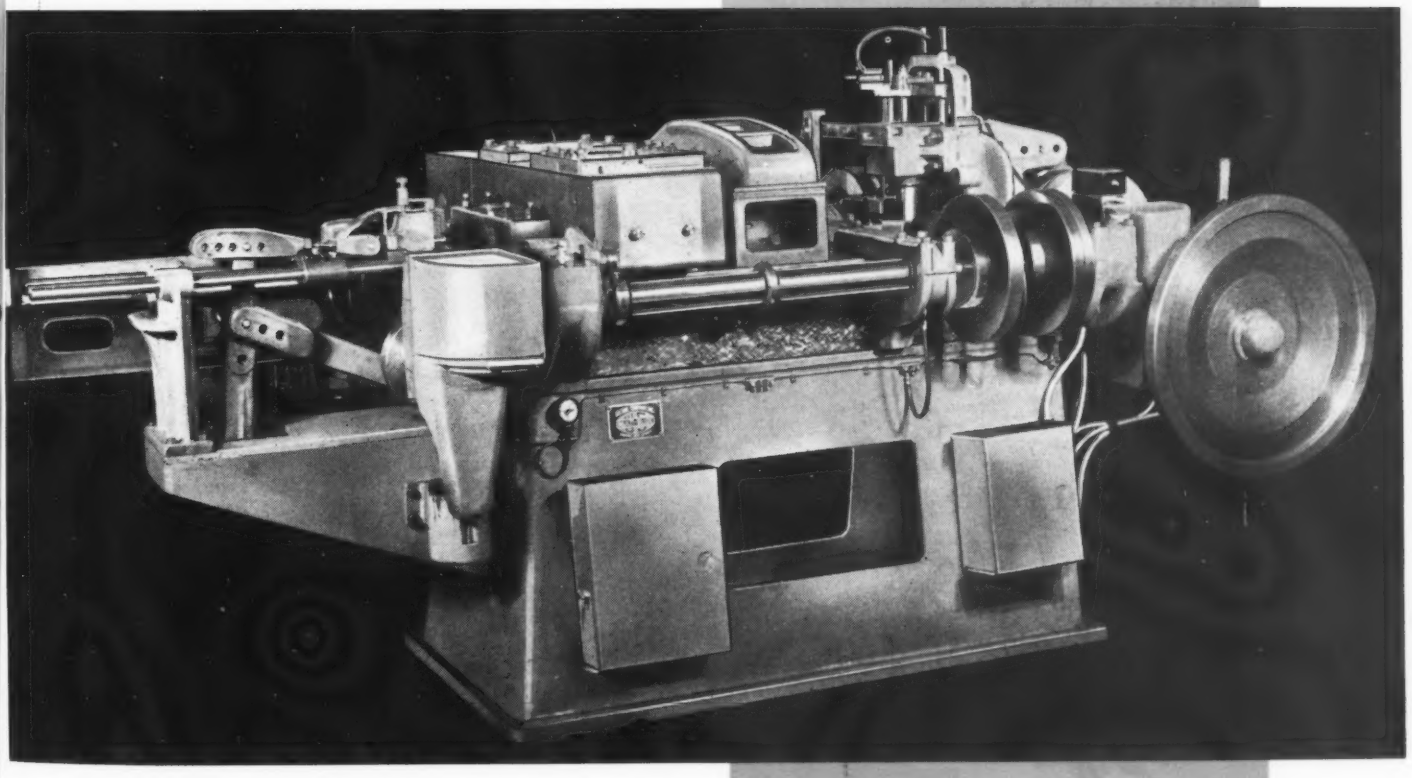
BUILDERS . . .

STAINLESS STEEL SHINGLE NAILS PRODUCED 875 PER MINUTE



ON THE #35 U.S. MULTI SLIDE

The No. 35 U. S. Multi Slide. Maximum width of stock that can be handled, 3". Feed length obtainable, 12½". Overall size of machine, 57" high by 55" wide by 147" long. Net weight, 9560 pounds. Motor, 7½ H.P.



(East Orange), N. J.

—U. S. DIE SETS AND ACCESSORIES

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MAGNIFIED 6 TIMES ACTUAL SIZE

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AND 5 OTHER VALUABLE PRIZES

First Prize ..... **$1,000.00 cash**

Second Prize ..... **$200.00 cash**

Third Prize ..... **$50.00 cash**

Fourth Prize ..... **Set of 4 dozen drills, any size you want.**

Fifth Prize ..... **Set of 2 dozen drills, any size you want.**

Sixth Prize ..... **Set of 1 dozen drills, any size you want.**

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TERMS OF THE CONTEST

1. This contest does not cost you a cent, nothing but a little time and thought. No forms to fill out, either. Just typewrite your suggestions on a sheet of white paper the size of this page (smaller sizes might get lost) and write your name and address.
2. There's no limit to the number of names you can send in.
3. Any person residing in the continental U.S. may submit entries—except employees and the families of employees of Morse Twist Drill & Machine Co., and its advertising agency.
4. In case of duplication of winning name, duplicate prizes will be awarded.
5. No entries can be returned, and all entries become the sole property of Morse Twist Drill & Machine Co.
6. Entries must be postmarked not later than midnight, March 15, 1949.
7. The decision of the judges will be final.
8. *Address all entries to:* NEW NAME CONTEST, Morse Twist Drill & Machine Co., New Bedford, Mass.

WINNERS WILL BE ANNOUNCED IN THE MAY ISSUE OF THIS AND OTHER INDUSTRIAL MAGAZINES . . . WATCH FOR THEM!

FEATURES OF NEW MORSE DRILL: This new gold-colored Morse Drill delivers 50% more production, on multi-spindle automatic machines. This longer life comes from greater toughness and flexibility . . . and guarantees substantial savings because of far fewer drill-changeovers.

Here is a *completely new* drill . . . ground from the solid, with heavier web, increased twist, and wider flutes that clear chips through hole and jig bushing in a fast easy flow. *But here's the final payoff:* Morse has added something new to drill manufacture . . . *an extra, exclusive process* that gives this drill more strength *—more plain fighting guts to withstand higher speeds—* than any other drill. This has been proved by thorough field tests. 58 sizes, from No. 80 to ⅛", are now available through Morse-Franchised Distributors.

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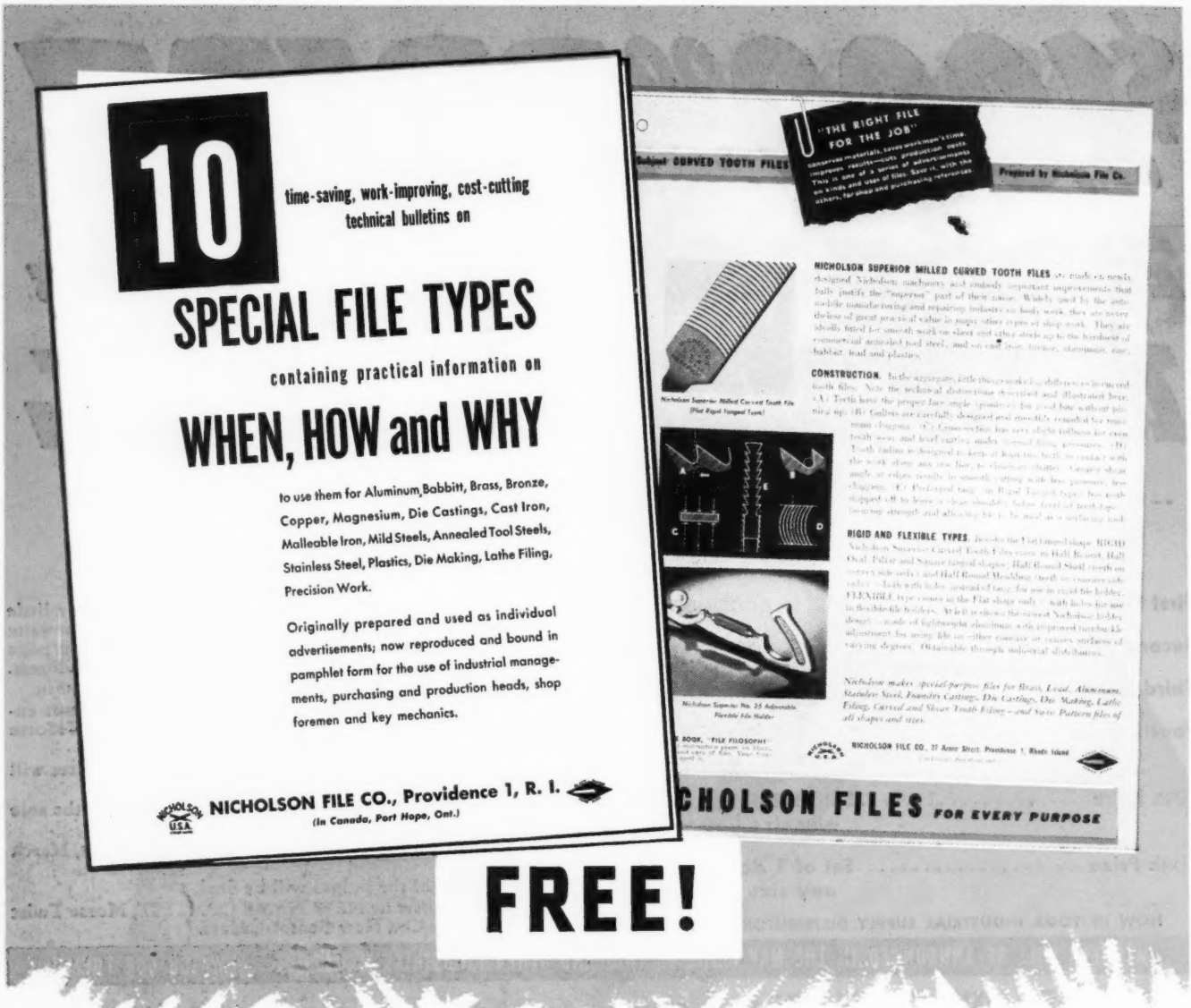
NEW BEDFORD, MASSACHUSETTS

A DIVISION OF VAN NORMAN COMPANY

BRANCH WAREHOUSES: NEW YORK, DETROIT, CHICAGO, SAN FRANCISCO


10
time-saving, work-improving, cost-cutting technical bulletins on
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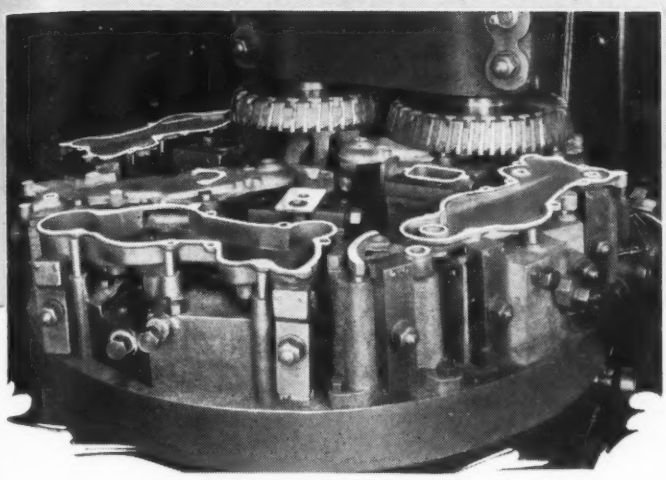
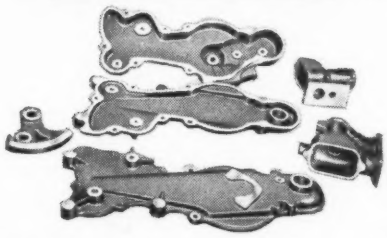
NICHOLSON FILES ***FOR EVERY PURPOSE***

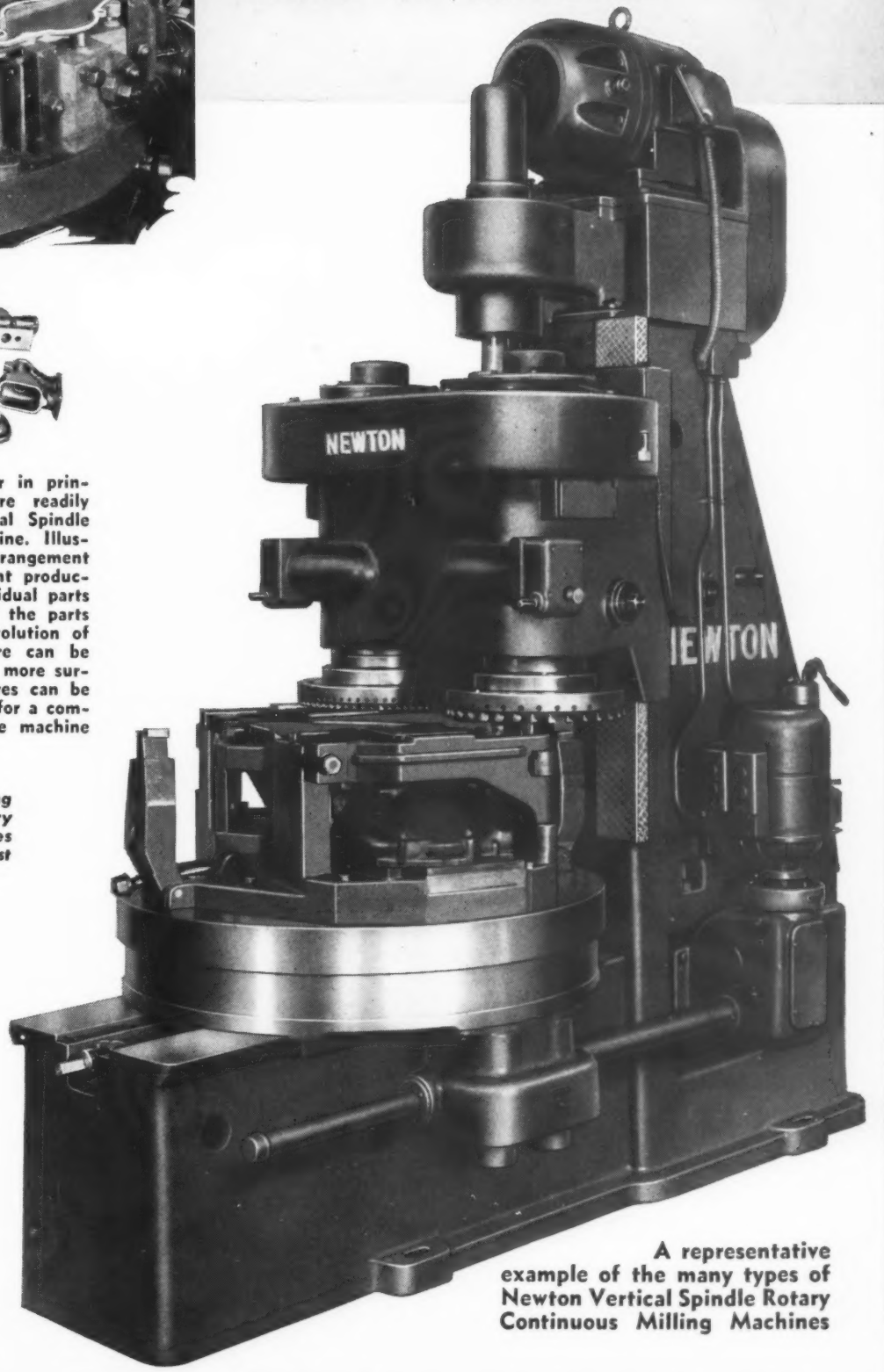
Let one machine with one operator do the work of several





Work-piece arrangements, similar in principle to that shown above, are readily handled on any Newton Vertical Spindle Rotary Continuous Milling Machine. Illustrated here is a fixture arrangement especially adapted to smaller plant production where the quantity of individual parts to be finished is limited. All of the parts shown can be milled at one revolution of the table. Similarly, the fixture can be arranged to accommodate two or more surfaces of the same piece. Fixtures can be arranged to mill all parts needed for a complete assembly, thus keeping the machine in continuous production.

Complete information covering Newton Vertical Spindle Rotary Continuous Milling Machines will be furnished upon request



A representative example of the many types of Newton Vertical Spindle Rotary Continuous Milling Machines

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
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DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
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DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
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AND OTHER SPECIAL MACHINES

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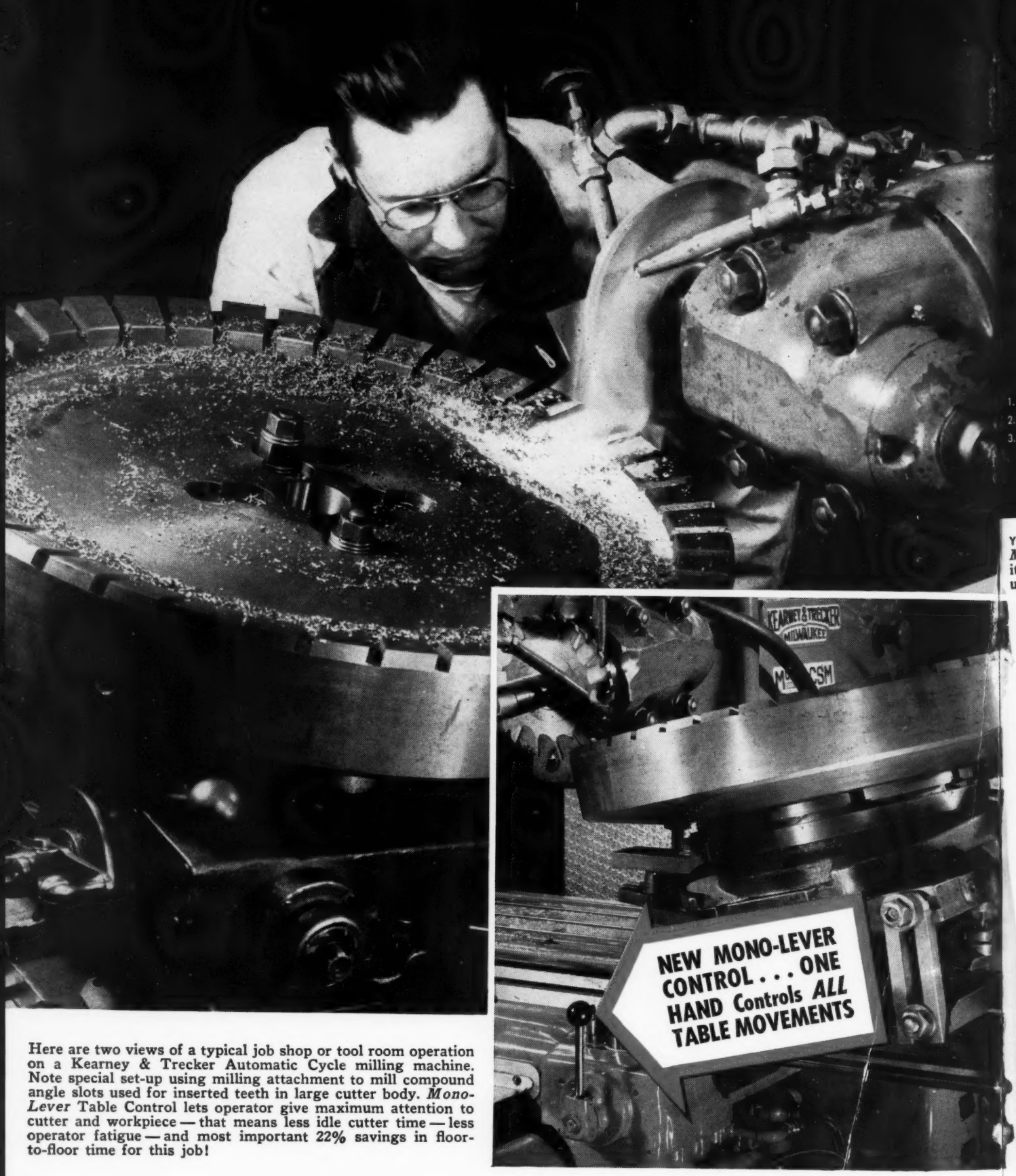
ROCHESTER 10, NEW YORK

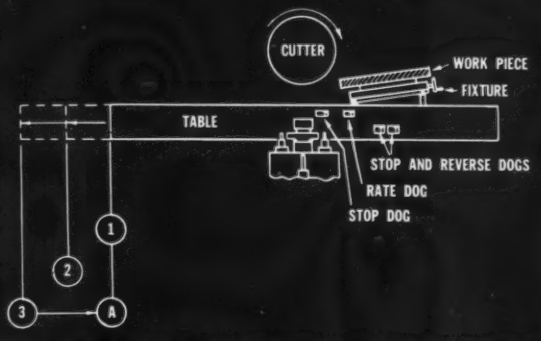


Here are two views of a typical job shop or tool room operation on a Kearney & Trecker Automatic Cycle milling machine. Note special set-up using milling attachment to mill compound angle slots used for inserted teeth in large cutter body. *Mono-Lever* Table Control lets operator give maximum attention to cutter and workpiece — that means less idle cutter time — less operator fatigue — and most important 22% savings in floor-to-floor time for this job!

In face of rising costs . . CAN YOU CYCLE TIME SAVINGS

HOW JOB IS DONE

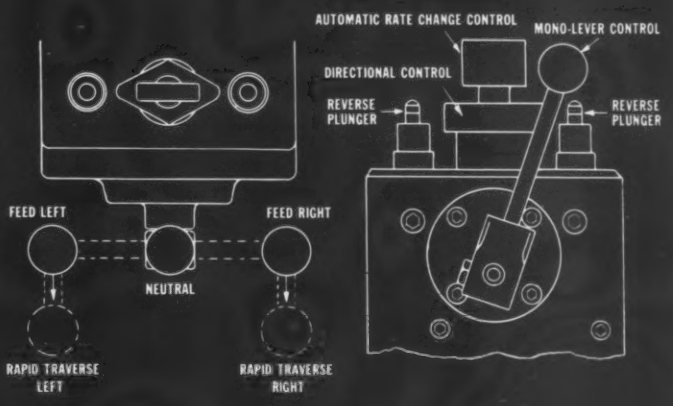
USING AUTOMATIC TABLE CYCLE AND MONO-LEVER CONTROL



1. Operator engages Mono-Lever. Table advances in rapid traverse to point of cut (2).
2. Feed dog changes rapid traverse to feed for cut. Table feeds through cut to (3).
3. Stop and reverse dogs reverse table in rapid traverse back to starting point (A) to stop. Operator indexes workpiece and repeats cycle.

HOW IT WORKS

AUTOMATIC TABLE CYCLE and MONO-LEVER CONTROL UNIT



YOU'RE LOOKING at a diagram of the job at the left. See how *Mono-Lever* Control and Automatic Table Cycling make it easy for the operator . . . speed up production. No wonder users report 16 to 31% savings in cycle time alone.

THINK OF IT! Now you can have all the advantages of this great cost-cutting feature plus the all-around versatility of general purpose, knee-type machines . . . faster, easier control for greater production with less operator fatigue.

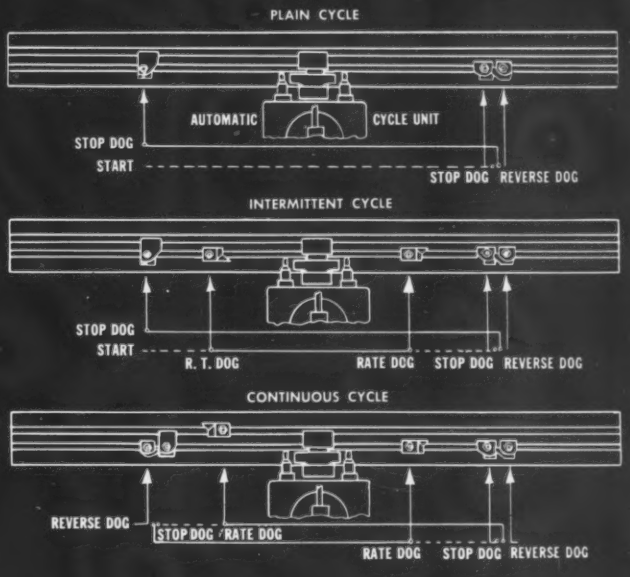
YES! Kearney & Trecker's constant research and development program — always directed at getting greater production at lower costs — has found what you have been looking for.

They're new knee type milling machines that combine mass unit production and versatility for general purpose and job shop work. Kearney & Trecker Milwaukee knee-type milling machines equipped with Automatic Table Cycle and *Mono-Lever* control *do just that.* They offer you *right now* the opportunity to mill *more units* with *more profit* in *less time.*

Of equal importance to you is the opportunity for proper machine selection. You neither *over-buy* nor *under-buy*, but you buy *right* when you choose from the *56* machines in this new Kearney & Trecker line.

For some startling facts about these machines and their application to your milling work, consult a Kearney & Trecker Sales Representative today. He's been schooled in the "know-how" and he's at your service. For detailed information, contact him or write us direct. Ask for catalog No. AC-10A. Kearney & Trecker Corp., 6784 W. National Avenue, Milwaukee 14, Wisconsin.

TYPICAL CYCLES YOU CAN USE



THREE DIFFERENT TYPICAL CYCLES to accommodate various length of runs. Using the completely automatic cycle feature effects savings of up to 31% for lots of 10 or more pieces. Cycle can be pre-set to meet operators required loading and unloading time and can be reversed in feed or rapid traverse.

AFFORD TO PASS UP UP TO 31% OR MORE?

TEAMWORK

THE AMERICAN TOOL WORKS CO.

K FOR PROFIT

Courtesy of Fairbanks, Morse & Co.

Quality Tools produce a Quality Product . . .

Fairbanks, Morse & Co., one of the world's leading manufacturers of Electrical Equipment and Diesel Engines, uses scores of "American" Hole Wizard Radial Drills to produce quality at a profit.

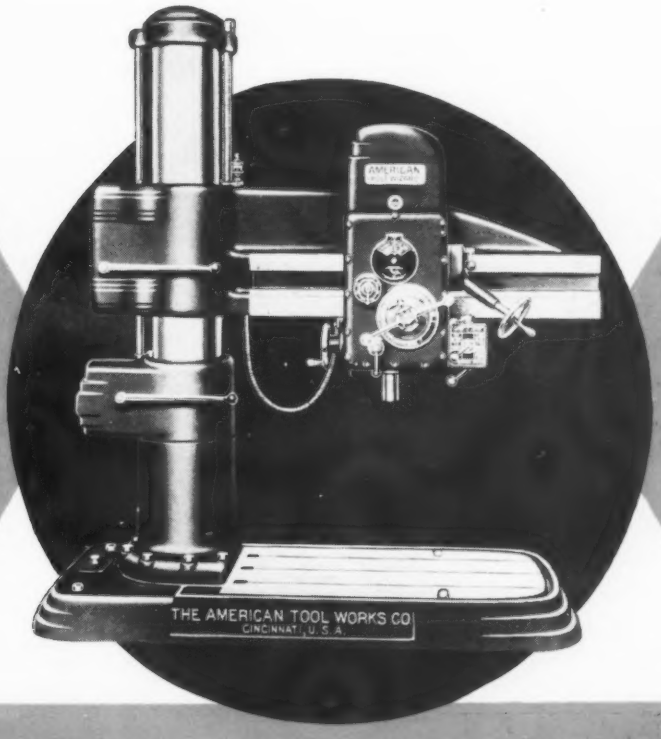
The smooth operation and easy handling of "American" Radials give them front rank recognition amongst users as dependable producers of accurate and finely finished work.

The directly connected, head mounted motor guarantees maximum power at the spindle.

Finger-tip and direct-reading controls insure speedy manipulation for greater work production.

Anti-friction mounting of head on arm and convenient location of all operating levers mean less operator fatigue and more work at day's end.

For quality work at a profit your best bet is "AMERICAN".



Lathes and Radial Drills **Cincinnati, Ohio U.S.**

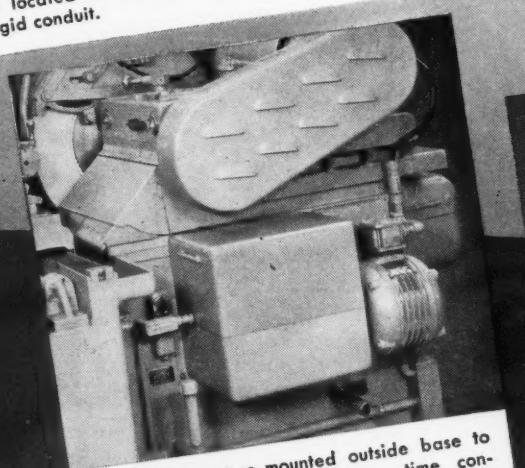
More about the cost-saving features

Pre-set Truing and Grinding Speeds — maintain separate table speeds for truing and for grinding—immediate selection by this lever.

Work Jogging with this fingertip lever, work may be jogged at any time — whether work rotation is being automatically or manually governed.

Electrical equipment servicing made easy. Major controls located in elevated, accessible cabinet. Note rigid conduit.

Hinged guard for rapid wheel change — **ramped outlet** to coolant tank for easy sludge removal.



Pumps and motors mounted outside base to insure convenience and minimum time consumption in maintenance and service.

Steel ribbon type guards provide complete protection of base ways and require no extra floor space.

Abrasives - Grinding Wheels - Grinding and Lapping Machines - Refractories - Porous Mediums - Non-slip Floors - Norbide Products - Labeling Machines

of the NORTON TYPE CTU CYLINDRICAL GRINDERS

NORTON grinding machines are designed not only for precision and dependability—they're designed with cost-cutting operating and maintenance features! For instance, the new Type CTU machines provide:

For reduction of operating costs:

1. Pre-set Truing and Grinding Speed Control
2. Work Jogging Control
3. Automatic Controls
   - (a) Automatic wheel feed at table reversals
   - (b) Automatic re-set after grinding to size
   - (c) Automatic Work Start-Stop
   - (d) Automatic Coolant Control

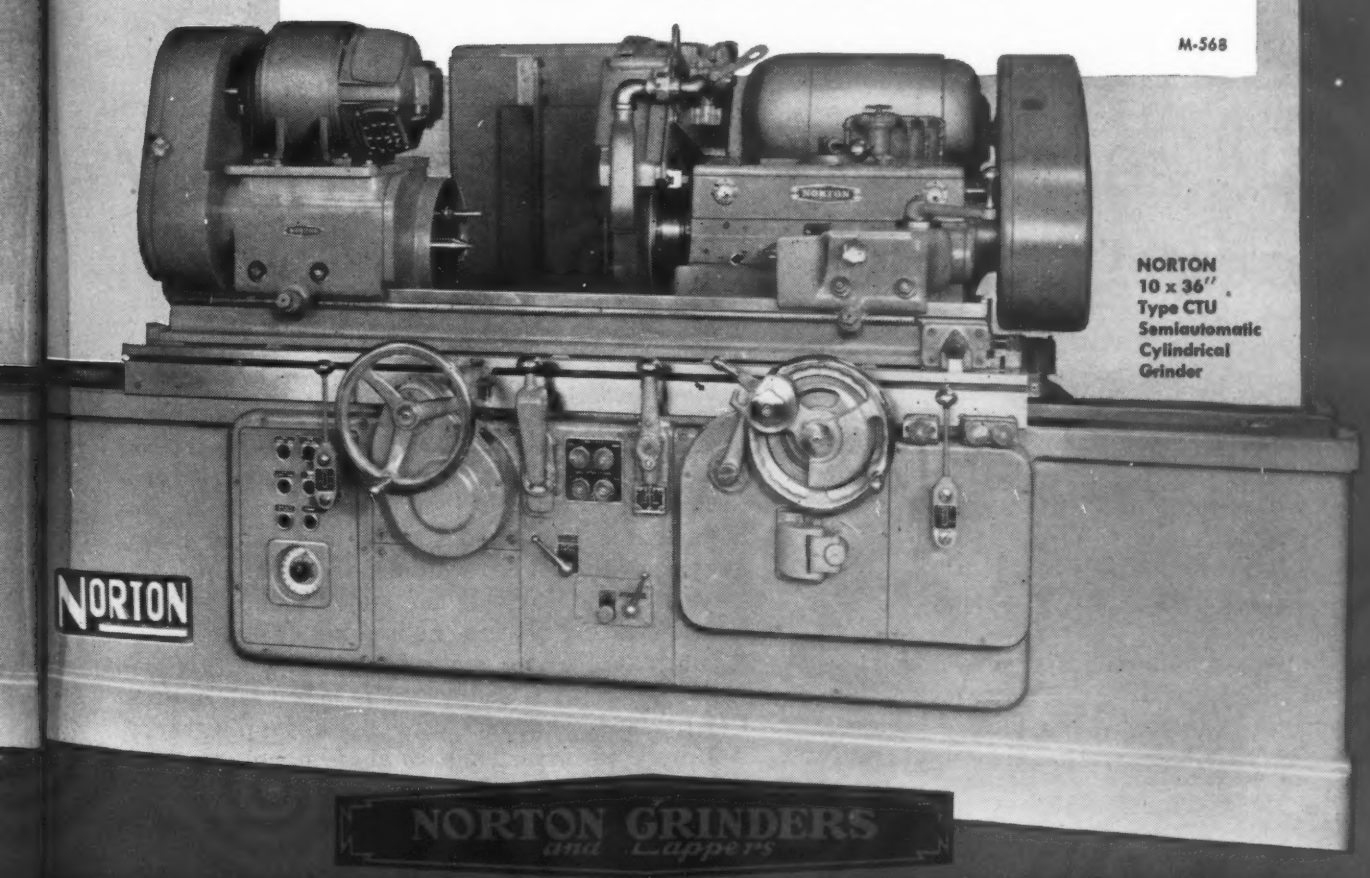
For reduction of maintenance costs:

1. Grouping of electrical controls
2. Hinged-type wheel guard
3. Coolant clean-out ramp
4. Pump mountings outside base
5. Ribbon-type base way guards

Such features mean real savings. They reduce the need for high operating skill—lessen effort—speed production—and greatly reduce "down time" for maintenance.

Write for catalogs—no obligation of course.

M-568



NORTON
10 x 36" Type CTU Semiautomatic Cylindrical Grinder

NORTON COMPANY, WORCESTER 6, MASS · New York · Chicago · Detroit · Cleveland · Hartford · Distributors in All Principal Cities

A Great Seller

...because it's a Comfortable Eye-Protector!

AO F-9200 Acetate Goggle

When we brought it out, we were sure there was a great future ahead for this goggle of non-flammable cellulose acetate butyrate—but its popularity has surprised even ourselves! Here are its features that workers appreciate:

1. ASSURED PROTECTION.
2. Hinges and temples out of line of sight.
3. Smarter appearance.
4. Lenses that conform to and cover eye orbit.
5. Improved fit.
6. Comfortable, lightweight, face-formed bridge.
7. Nosepads which distribute goggle weight *evenly*.

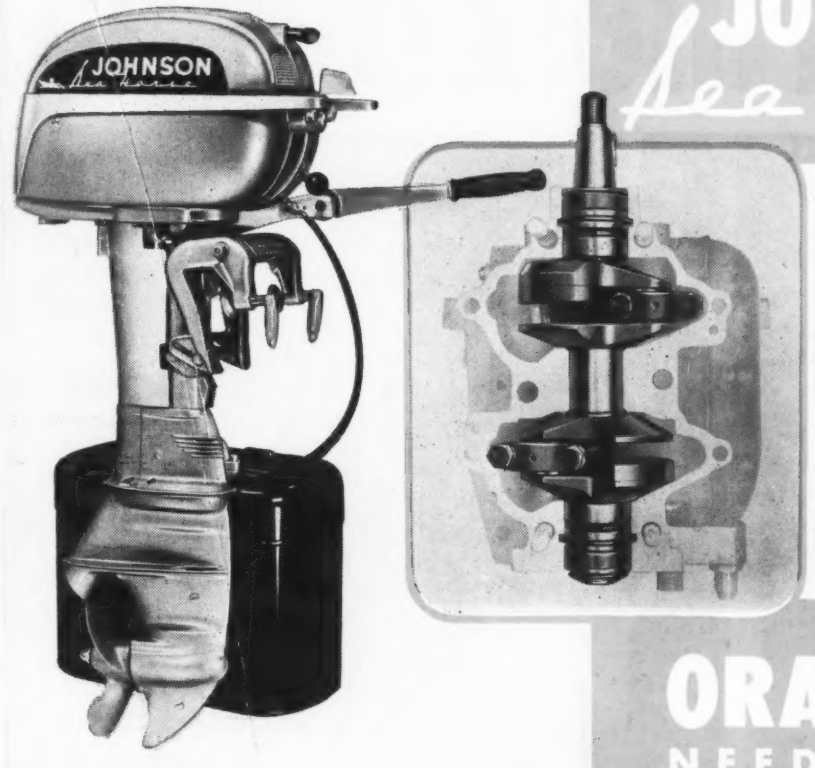
This goggle does a prime protection job on operations in chemical and electrical plants where the tiniest spark might cause fire or explosion. Because of its acetate construction it is especially recommended for these and similar jobs where metal goggles might not be recommended. Available with ventilated side shields for added safety against lateral-striking objects. Lenses are 6-Curve Super Armorplate. When protection from glare, ultraviolet or infra-red radiations is a "must", specify Calobar lenses. For a handy source of supply, see the AO representative. There is always one near you.

Safety Division of American Optical COMPANY

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

In the New

JOHNSON Model QD Sea Horse



—the Main Crankshaft Bearings run on

ORANGE Cage Type NEEDLE BEARINGS

A boatman's and fisherman's dream . . . the new Model QD, 10 hp. Johnson Sea Horse Outboard Motor was released for production by the Johnson engineering department only after years of careful design and ruthless testing. Out of these tests came the selection of Orange Cage Type Needle Bearings for the main crankshaft bearings, to assure in this exacting vertical application, performance that upholds the famous Johnson reputation for dependability.

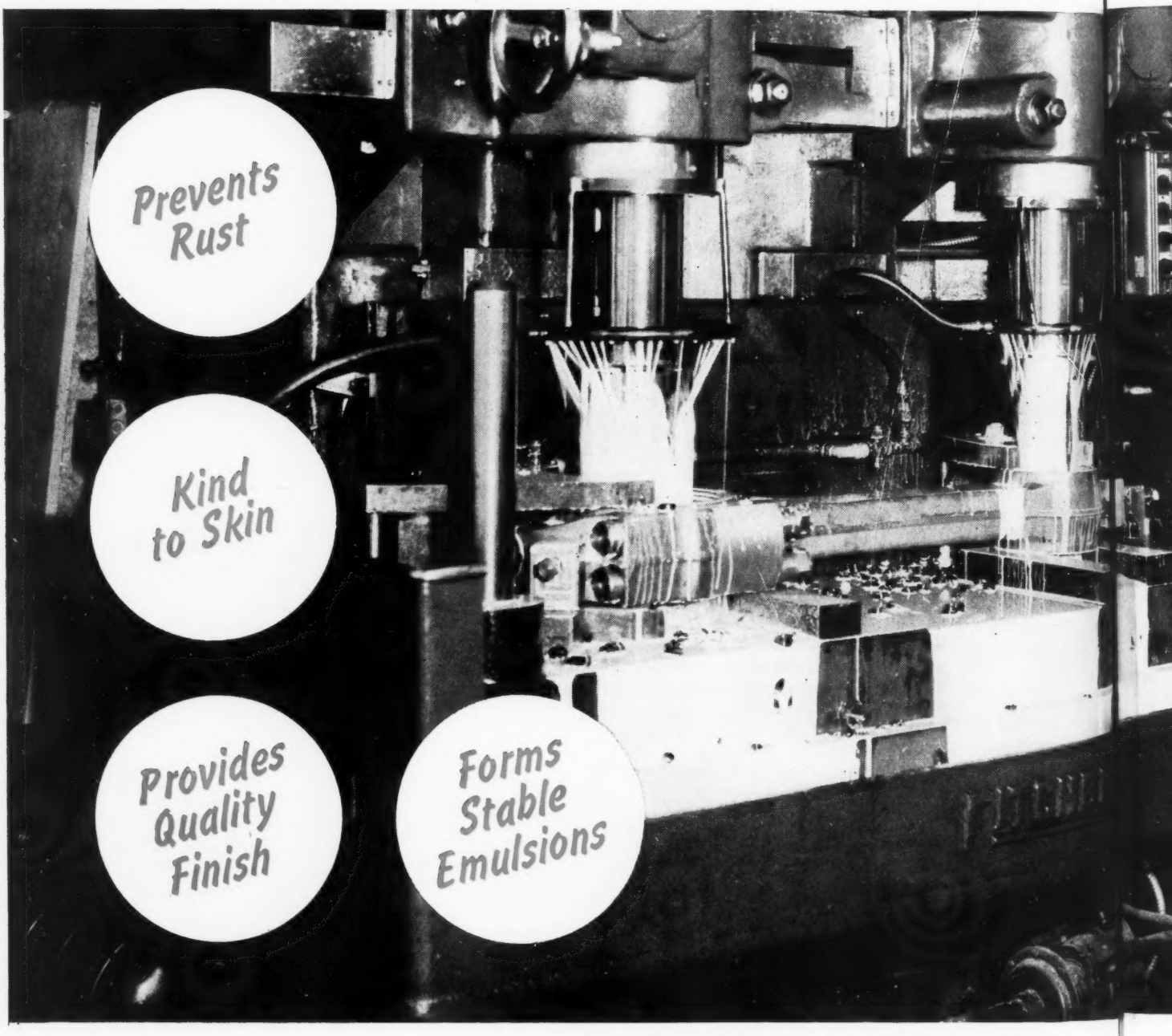
MORE and more, design engineers are finding Orange Cage Type Needle Bearings the answer for applications where conventional needle bearings fall short. For example, in vertical applications, such as the above—overhung applications—high speed applications—extreme precision specifications.

The Orange Cage Design holds rollers in permanent alignment, preventing skewing. Internal clearances can be accurately controlled to meet exacting requirements, which especially adapts them to spindles and high speed applications. Experience shows that Orange Cage Type Needle Bearings create less internal friction, provide smoother running and longer life hours expectancy. Consult our engineers on any application.

Write for Engineering Data Book showing sizes, capacities, design, etc.

ORANGE ROLLER BEARING CO., Inc. 552 Main St., Orange, N. J.

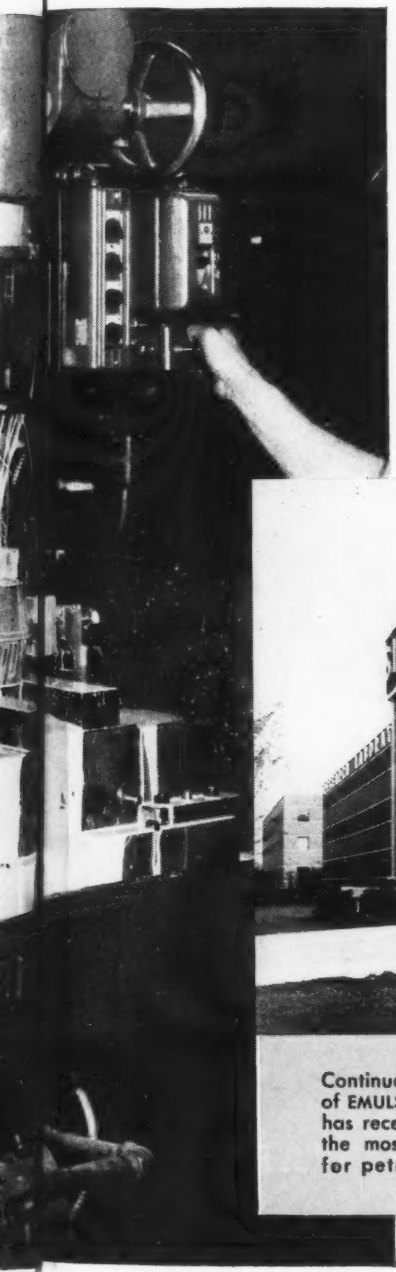
Sinclair EMULSICOOL Fine Product



SINCLAIR

YOUR NEAREST SINCLAIR AGENT WILL GLADLY ARRANGE

Gives Finish at Less Cost



One of the ever-present concerns in metal working production shops is cost of production. In many operations the use of Sinclair EMULSICOOL as the cutting fluid helps solve this problem. Without sacrificing tool life EMULSICOOL provides high quality finish at less cost.

EMULSICOOL mixes easily with any water—hard or soft—to form stable emulsions. EMULSICOOL has rust protective qualities, too. It does not affect the operator's skin and eliminates troublesome gumming of the machines.

For fine finish, clean operation, easy handling and rust protection, EMULSICOOL is the ideal,economy soluble oil.

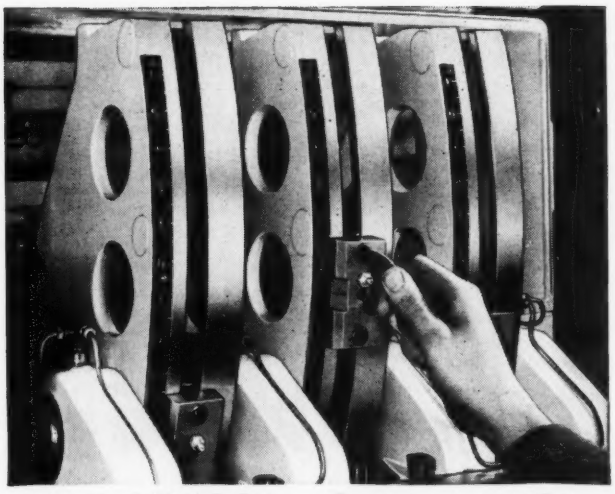
Continual research explains the high quality of EMULSICOOL and other Sinclair Oils. Sinclair has recently completed at Harvey, Ill., one of the most modern and complete laboratories for petroleum research and development.

E. W. Isom, Sinclair Vice-President in Charge of Research says: "With the new facilities now made available to us at Harvey, Ill., we expect to find many ways to help industry cut costs through better petroleum products."

INDUSTRIAL OILS

FOR LUBRICATION COUNSEL, OR YOU MAY WRITE TO SINCLAIR REFINING COMPANY, 630 FIFTH AVE., NEW YORK 20, N. Y.

No cam worries with a Warner & Swasey 5-Spindle Automatic



Patented "Quick Set" quadrants cut set-up time, quickly adjust to any feed stroke between 0 and 5 inches.

NO CAMS TO DESIGN

NO CAMS TO MACHINE

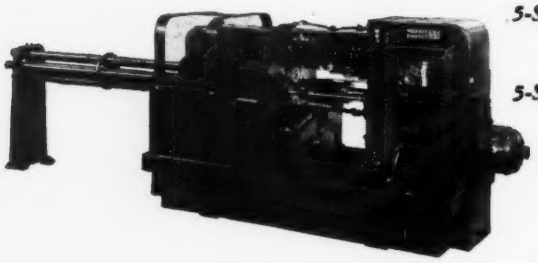
NO CAMS TO STORE

NO CAMS TO FIND

JUST make a simple setting and there you have your new feed stroke, clearly indicated on a graduated scale. Yes, it's as easy as that! All feed strokes are quickly available for both longitudinal and cross slides. No more need to sacrifice cycle time because the "right" cam is not on hand or because a cam change would take too long. You always get your exact feed stroke quickly on the Warner & Swasey 5-Spindle Automatic.

Full information on these new machine tools will show you how their many new features and design improvements can cut costs, boost production in your shop. Ask your nearest Warner & Swasey office for full particulars or write to Warner & Swasey, Cleveland 3, Ohio.

NO CAMS TO CHANGE



5-Spindle Bar Machines
—1¼" Standard Capacity
—2¼" Oversize Capacity
5-Spindle Chucking Machine—6" Swing

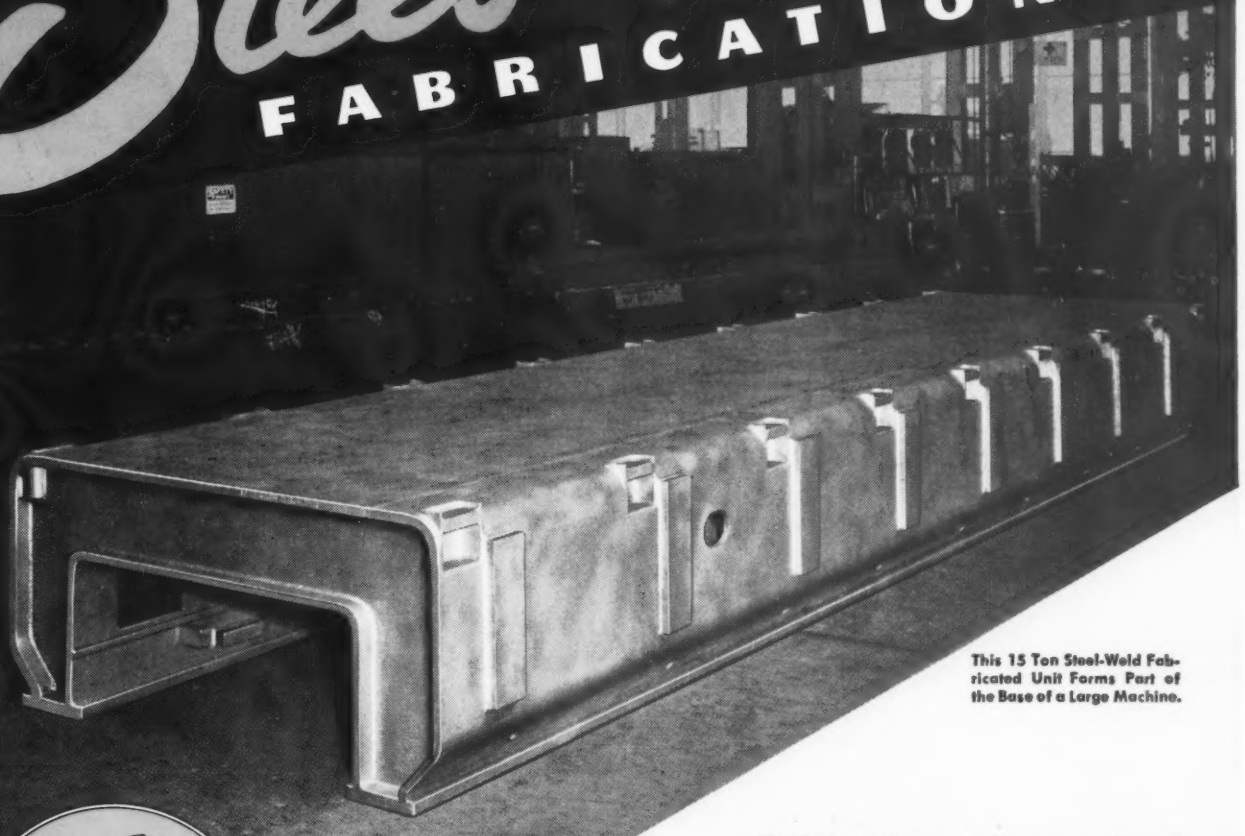
IT'S SIMPLE TO SET UP

You Can Machine it Better, Faster, for Less.. with a Warner & Swasey

WARNER & SWASEY
Machine Tools
Cleveland

TURRET LATHES, MULTIPLE & SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

Steel-Weld FABRICATION



This 15 Ton Steel-Weld Fabricated Unit Forms Part of the Base of a Large Machine.

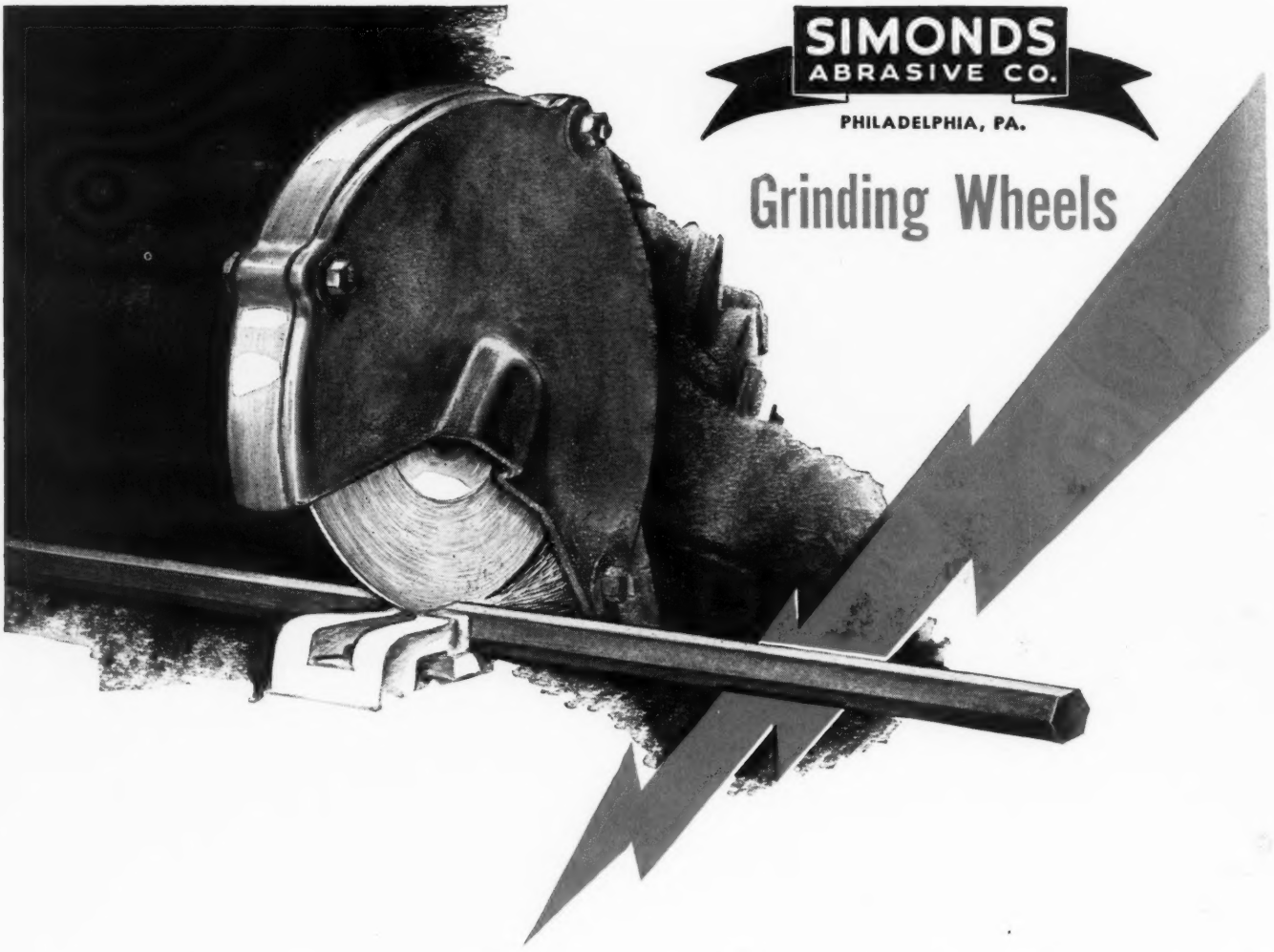
Welded steel bases, frames and parts of heavy machinery in any shape, size or weight, are turned out by Mahon in record time.

Whatever your requirements may be, you will find the Mahon Company an excellent source for welded steel in any form . . . a source equipped to provide complete machining service on any Steel-Weld fabricated parts or products regardless of size or weight. Mahon's staff of thoroughly competent design engineers, backed by craftsmen highly skilled in the latest techniques in the welding art, are your assurance of a better, smoother appearing job, embodying every advantage of Steel-Weld Fabrication.

THE R. C. MAHON COMPANY
DETROIT 11, MICHIGAN

Engineers and Fabricators of Welded Steel Machine Bases and Frames, and Many Other Welded Steel Products

MAHON



SIMONDS
ABRASIVE CO.
PHILADELPHIA, PA.

Grinding Wheels

How fast is fast?

With Simonds Abrasive Wheels the answer is not merely in revolutions per minute . . . but in maximum efficiency per revolution . . . top production per operation . . . greater economy per wheel dollar . . . longer service per wheel.

The answer also lies in selective scope and availability—and Simonds Abrasive offers you both—a line of grinding wheels in every desired combination of grain, grade and size, plus a distributor service constantly geared to your requirements.

Let's send you the name of your nearby distributor and a copy of our Data Book describing Simonds Abrasive Company's complete line.

SIMONDS
ABRASIVE CO.
Philadelphia, Pa.
Grinding Wheels and Abrasive Products

SIMONDS
CANADA ABRASIVE CO. LTD.
Arvida, Quebec
Electric Furnace Abrasives

SIMONDS ABRASIVE COMPANY
is a division of

SIMONDS
SAW AND STEEL CO.
Fitchburg, Mass.
Saws, Machine Knives, Files

Other Divisions

SIMONDS STEEL MILLS
Lockport, N. Y.
Special Steels

SIMONDS CANADA SAW CO. LTD.
Montreal, Can.
Simonds Products for Canada

SIMONDS ABRASIVE COMPANY, PHILADELPHIA 37, PA. DISTRIBUTORS IN PRINCIPAL CITIES

How to keep operators in the pink . . .

Specify the cutting fluid operators call the biggest working improvement in years—Cimcool°.

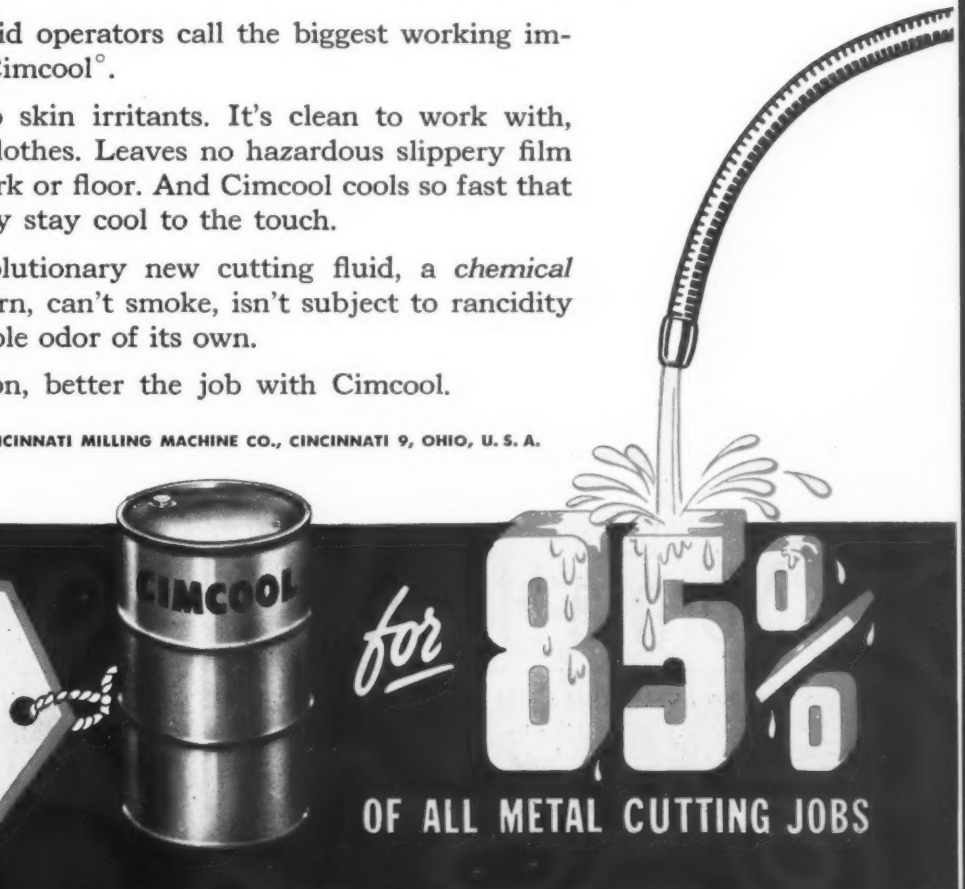
Cimcool contains no skin irritants. It's clean to work with, doesn't soil hands or clothes. Leaves no hazardous slippery film on hands, machine, work or floor. And Cimcool cools so fast that tools and chips actually stay cool to the touch.

Cimcool is the revolutionary new cutting fluid, a *chemical emulsion* that can't burn, can't smoke, isn't subject to rancidity and has no objectionable odor of its own.

For better production, better the job with Cimcool.

CIMCOOL DIVISION OF THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO, U. S. A.

°Trade Mark Reg. U. S. Pat. Off.



A Production-Proved Product of
THE CINCINNATI MILLING MACHINE CO.

for 85%
OF ALL METAL CUTTING JOBS

You don't have to Wish for Efficiency

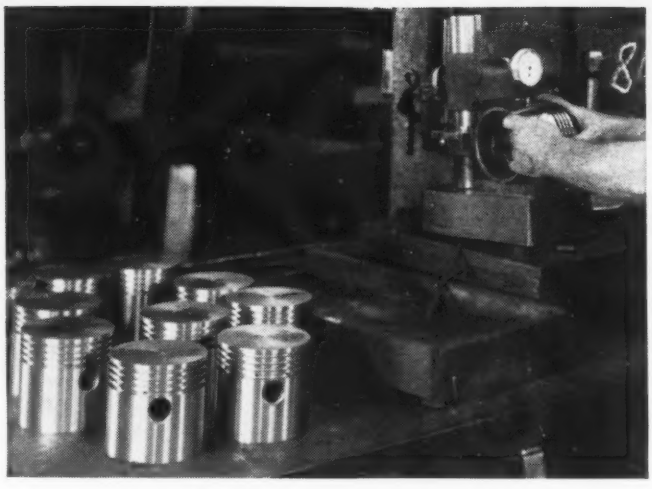
Bearing performance becomes a reality when you use the Norma - Hoffmann "Cartridge" Bearing in your products. This double-row width bearing has 100% greater grease capacity than conventional bearings. The highly efficient seals lock grease in . . . keep dirt out. Carefully factory-packed with Norma-Hoffmann's specially compounded grease assures high antifriction performance for years on end. These are but a few of the reasons why the Norma-Hoffmann "Cartridge" Bearing is *"America's No. 1 Sealed Bearing."*

Norma-Hoffmann

AMERICA'S NO. 1 SEALED BEARING

NORMA-HOFFMANN BEARINGS CORP.
Stamford, Connecticut

Field Offices: New York • Chicago • Cleveland • Detroit
Pittsburgh • Cincinnati • Los Angeles • San Francisco • Dallas
Seattle • Phoenix



SUPERLA Soluble Oil

Gain these benefits for your grinding operations

AIMING at higher production and economy, a midwest plant tried various soluble oils for the cylindrical grinding of cast-iron automotive pistons. Approximately .001 of an inch of stock is removed. Six Norton grinding machines are used on the job.

Of the products tried, Superla Soluble Oil proved superior to any and helped this plant reach its goal through these benefits:

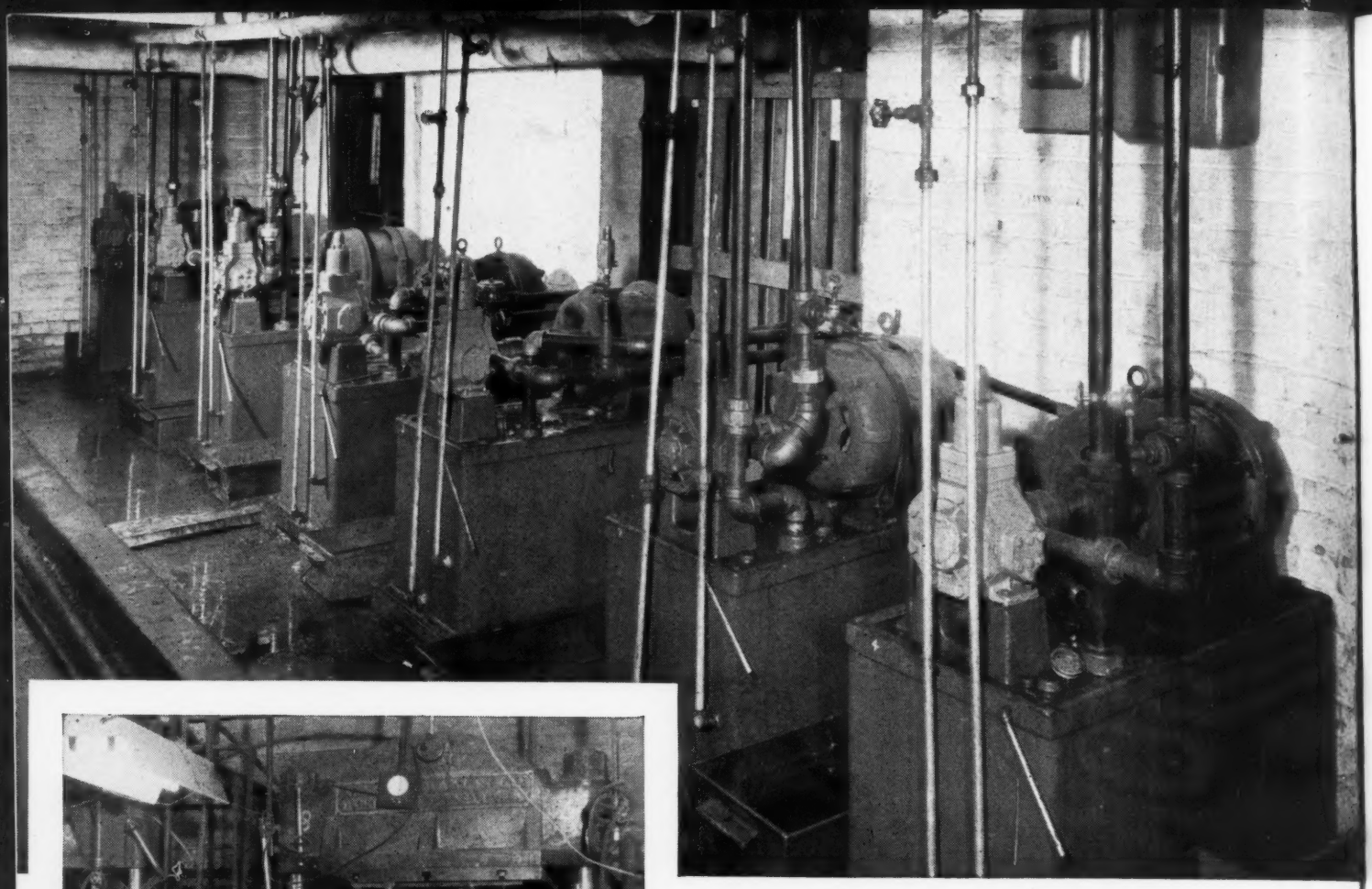
Fewer wheel dressings. 70 to 80 pistons are produced before wheels need dressing as compared to an average of 30 to 40 pistons obtained with other soluble oils. This amounts to a big saving through reduced time and labor for dressing wheels.

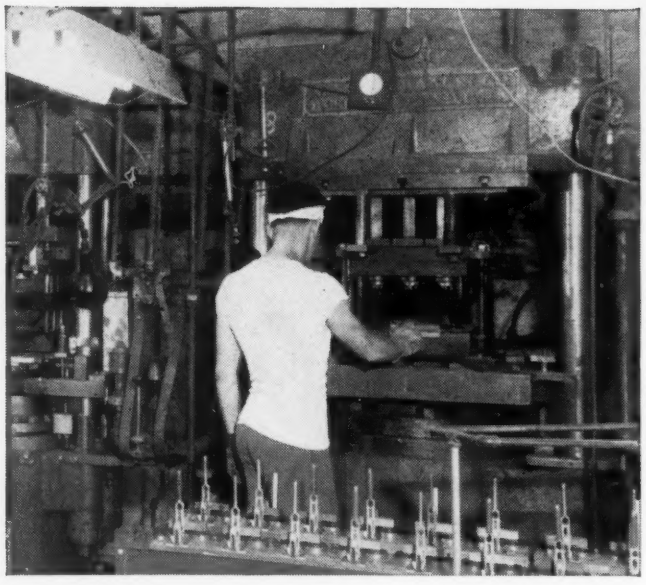
Greater production. Less interruption for wheel maintenance adds approximately 40 minutes to the daily production time of each machine.

The shop foreman reports still other advantages in using Superla Soluble Oil. Piston diameters are easily kept within a tolerance of .0005 to .001 of an inch. There are no rusting troubles. Superla emulsions do not turn rancid and produce objectionable odors.

Why not gain these advantages offered by Superla Soluble Oil —advantages that will help you, in turn, to get greater production and economy in your plant. If your plant is located in the Midwest, write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, to secure the services of the Standard Cutting Oil Engineer nearest you.

STANDARD OIL COMPANY (INDIANA) STANDARD





Stanoil 95 Industrial Oil

Are your hydraulic operations as free of trouble as this?

THE HYDRAULIC UNITS shown above are used for the operation of plastic-moulding presses in a midwest plant. Hydraulic oil pressures reach 2500 psi. Oil temperatures average between 120° and 130° F. Presses, operating on a three-shift basis, require 24-hour operation of the hydraulic units.

Stanoil 95 has been used as the hydraulic medium in these units for well over a year. During this period of hard, continuous service, the hydraulic oil systems have required no cleaning. No oil changes have been necessary. Hydraulic controls have functioned smoothly.

How does this hydraulic oil performance compare with that in your plant? If you are experiencing trouble with oil deposits, oil deterioration, or oil foaming, you can benefit by changing to Stanoil. This multi-purpose industrial oil contains an oxidation inhibitor and an anti-foam additive that contribute to long oil life and clean, reliable operation of hydraulic units, speed reducers, and circulating systems.

If your plant is located in the Midwest, write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, to secure the services of the Standard Oil Lubrication Engineer nearest you.

STANDARD OIL COMPANY (INDIANA) STANDARD

12 examples of Cost Cutting

made possible by combining different operations in a Yoder cold roll-forming production line!

NO. 1 NOTCHING, PERFORATING, MAKING SPECIAL ENDS

In Yoder production lines, sheet and strip can be continuously cold formed, spot or seam welded, embossed, coiled, or curved and cut to length, without rehandling or extra labor cost. Different metals can be simultaneously fed into the machine and combined. Sheets or strip can be continuously slit to exact width, edges trimmed, rounded or beveled. Adhesives and other viscous liquids can be injected to fill openings, seams or grooves. Rubber, felt, plastics, etc., can be inserted and many other operations performed. Production ranges from 25,000 to 50,000 feet per 8-hour day with one single operator.

Illustration No. 1 is a Venetian blind header, No. 2 a furnace jacket ring, No. 3 a baby carriage section, No. 4 a lock-seam cloverleaf tube, Nos. 5 and 6 a window frame and sash section respectively. All the notches, perforations and special end profiles are made with special dies mounted in a Yoder automatic flying cut-off machine, synchronized with the roll forming machine. Into this line-up coiled strip is continuously pulled to be formed, notched, perforated and cut off at the rate of 100 f.p.m. or more, coming out at the other end as individual straight lengths, so accurately shaped and dimensioned as to be ready for immediate use or assembly.

Yoder engineers are anxious to cooperate with yours in developing similar high-production, low-cost methods to suit your individual needs. Literature, estimates and recommendations for the asking.

THE YODER COMPANY
5504 Walworth Ave. • Cleveland 2, Ohio

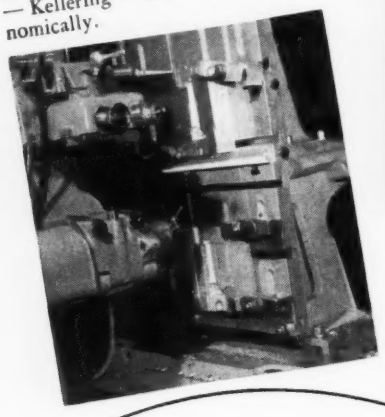
ENGINEERING YODER MANUFACTURING

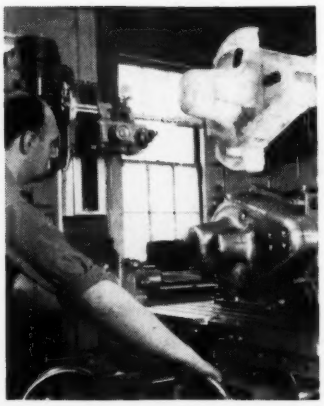
ROLL FORMING, TUBE MILL AND SLITTING MACHINERY

36 YEARS' LEADERSHIP • COILING • SLITTING • FORMING • EMBOSSING • CURVING • WELDING • CUTTING-OFF

DIES

This is a forging die cavity for jet engine impeller blades. P&W Keller Machines cut thousands of forging dies, some simple and some very complex. Tracer-controlled milling — Kellering — does the job economically.



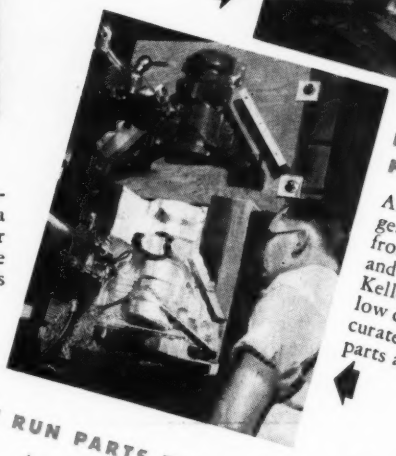


MOLDS

This steel mold for a precision aluminum casting is being cut from a wood master. Plaster or any other readily worked material is suitable for the master form. Plastic molds are made the same way.

PATTERNS

Here are two metal manifold patterns being cut simultaneously from a wood master pattern. Kellering is the quick way to get into production.

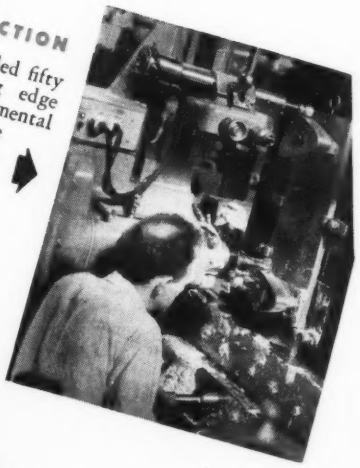


EXPERIMENTAL PARTS

An aircraft landing gear part being cut from a solid steel billet and a wood master. Kellering is the fast low cost way to get accurate finished test parts and pilot models.

SHORT RUN PARTS PRODUCTION

An aircraft company needed fifty magnesium wing leading edge segments for a new experimental plane. Angles and shape were complicated but Kellering solved it easily.



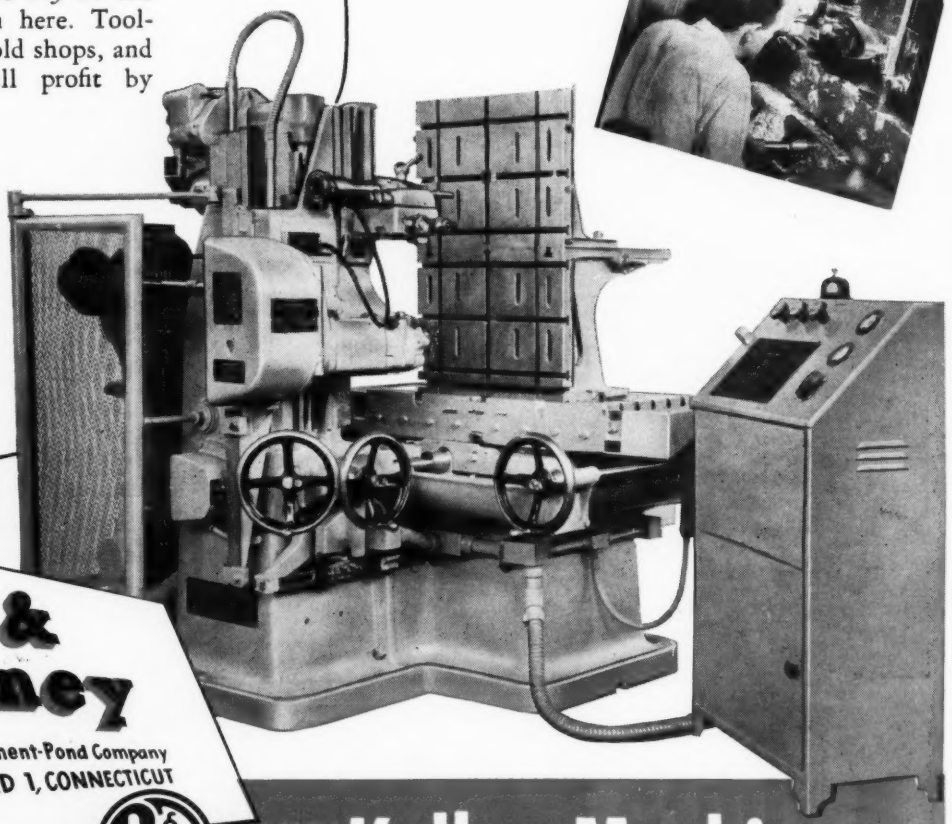
KELLERING

RINGS UP PROFITS

on ALL these DIFFERENT jobs

This is the Pratt & Whitney Keller, Type BL, that is duplicating and double-duplicating its original investment in short order. This one machine can handle *any* of the many kinds of work shown here. Toolrooms, tool and die shops, mold shops, and experimental departments all profit by Kellering.

It will pay you to look into the time and cost saving possibilities of Kellering. May we send you our latest Bulletin on the Type BL Keller? There is no obligation.



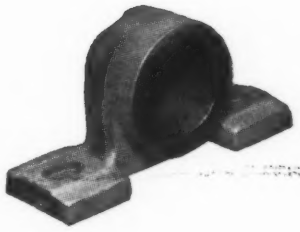
Pratt & Whitney

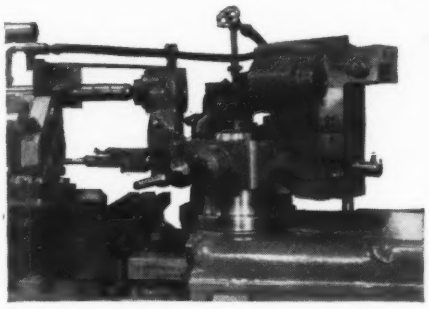
Division Niles-Bement-Pond Company

WEST HARTFORD 1, CONNECTICUT

Keller Machines

Take this Cast Iron Pillow Block





Apply this P&J Chucking and Tooling

The work is held in an air-operated combination chuck and fixture. Then:

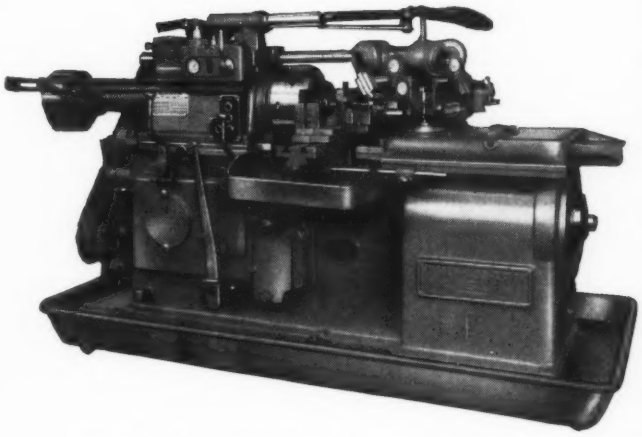
1st T. F.: Rough bore hole and two counterbores; chamfer O. D. of Hub

2nd T. F.: Finish above cuts; chamfer counterbore

3rd T. F.: Machine oil slinger groove; machine snap ring groove; rough form ball race and face end

4th T. F.: Machine ball radius with single point tool

5th T. F.: Size bore counterbore



Do The Job With Maximum Speed At Minimum Cost On This Powerful, Precise P&J 4DE Automatic Turret Lathe with 15 changes of speed arranged in 5 sets of 3 automatic changes; 27 feeds arranged in geometric progression; built for permanency of alignment, freedom from scoring, and long life.

WRITE FOR BULLETIN GIVING COMPLETE SPECIFICATIONS

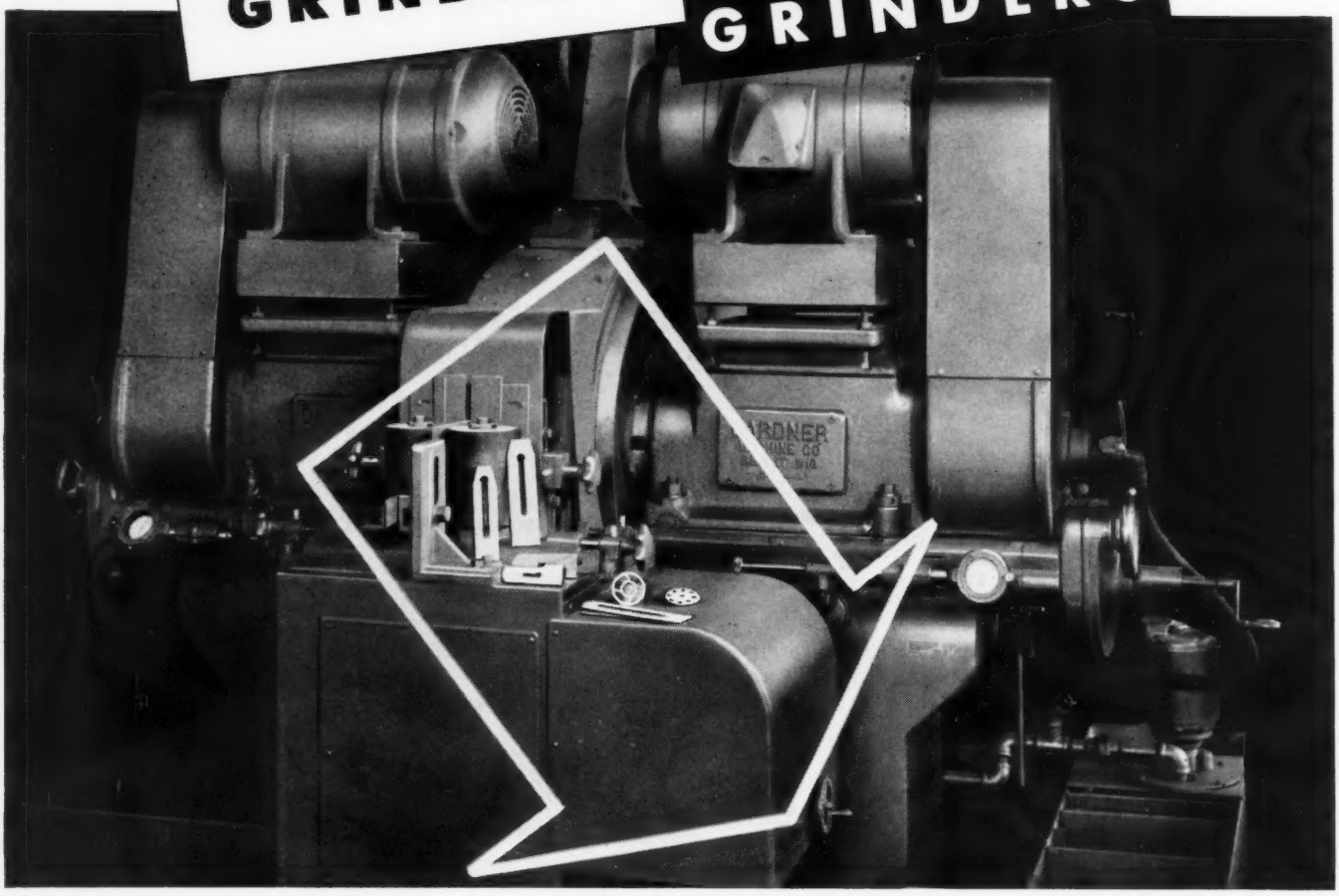
ALL THIS *Precision Work* DONE IN 2.28 MINUTES WITH P&J High Production Tooling ON THE P&J 4DE AUTOMATIC

Skilful tooling—the ability to group and combine operations, often on a single turret face—is the secret of the outstanding success with which Potter & Johnston combines high precision with high speed and consequent low cost parts production.

That is why you may find it very much worth your while to submit your parts or prints to P&J for tooling suggestions, estimates and time studies. It involves you in no obligation and may uncover savings of truly great significance.

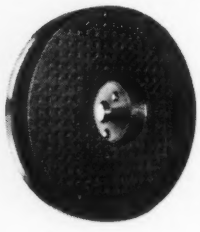
Potter & Johnston Company
Pawtucket, R. I.
subsidiary of Pratt & Whitney
Division Niles-Bement-Pond Company

FOR **FASTER GRINDING** USE **GARDNER *Double* GRINDERS**



SHOWN above, is one of many unusual parallel-surfacing jobs performed by the high-production "feed-thru" method — on GARDNER *Double* GRINDERS. Here, plane blades are fed to rubber rolls that guide them between opposed grinding wheels, where TWO sides are parallel-surfaced at ONE pass thru the machine. Food chopper blades also are fed thru this machine, on the same fixture, at the rate of 20 per minute.

For faster, lower-cost parallel-surfacing, investigate the advantages of GARDNER *Double* GRINDING.



Use Modern GARDNER WIRE-LOKT Abrasives on YOUR Disc Grinders!

WORK DATA

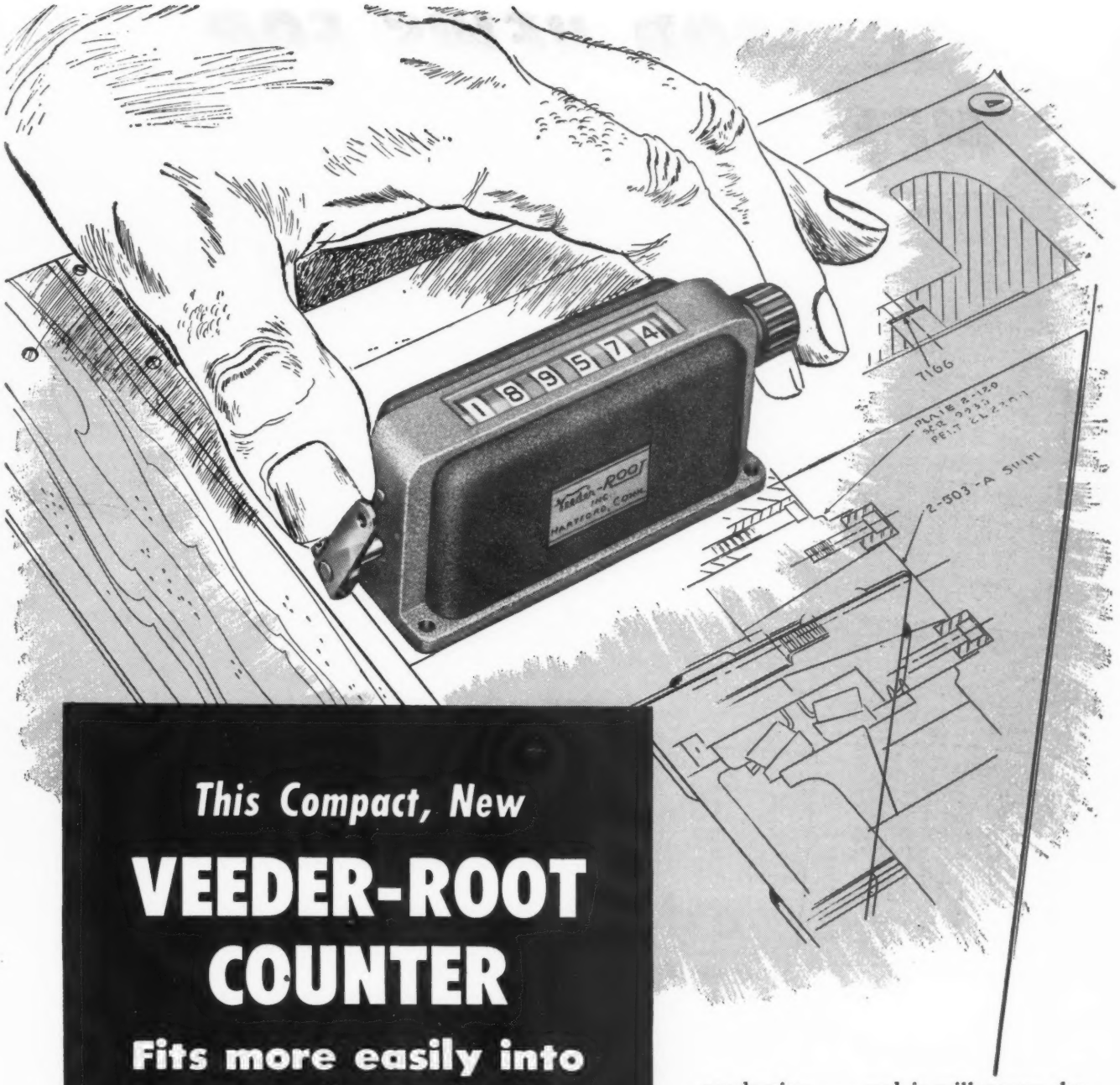
Part *Plane Blades*
Material *Steel*
Operation *Grind Two Parallel Sides*
Tolerances *Clean Up to Uniform Thickness*
Stock Removal *.012" to .015" Maximum Overall*
Production *4 to 6 Pieces Per Minute*
Feed *Hand Load to Rubber Feed Rolls*
Machine *No. 125-26" Gardner Double Grinder*

GARDNER-GRIND YOUR *Flat* SURFACES

WRITE FOR OUR *Double Grinder* BULLETIN!

GARDNER MACHINE COMPANY

414 East Gardner Street · · · · Beloit, Wisconsin, U.S.A.



This Compact, New

VEEDER-ROOT COUNTER

Fits more easily into any product-design

Trim and slim as a fine timepiece . . . and even easier to read . . . this new general-purpose Series 1260 is the most important news in counters since the Veeder-Root bicycle cyclometer of 1868!

This eye-catching counter, richly finished in 2-tone grey to set off the "Ease-Eye" direct-reading line of 6 bold figures, will measurably add to the *appearance* . . . to the *utility* . . . and to the *marketability* of any machine or product into which it is built as an integral part. It will deliver continuous *Facts in Figures* on any phase of operation or production . . . and it will prove the product's guarantee.

And the new 1260 will fit into the closest design-limitations. For it measures only 4½" long, 1 9/16" high, 1½" wide . . . weighs only 12 ounces. Speeds from 1,000 to 5,000 counts per minute, depending on type of drive: ratchet, revolution, direct, or geared. Capacity is 1,000,000 counts. Then one turn of the knob resets to all zeros.

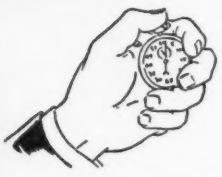
Look for this good-looking modern counter in the new machines and equipment you buy. And, by all means, look into its possibilities as a built-in *sales-builder for your own products.* Write.

VEEDER-ROOT INC.
Hartford 2, Connecticut

In Canada: Veeder-Root of Canada, Ltd., 995 St. James Street, Montreal 3. *In Great Britain:* Veeder-Root Ltd., Kilspindie Road, Dundee, Scotland

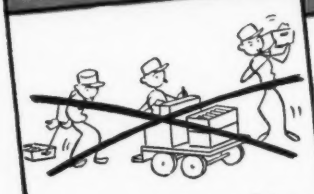
GOOD NEWS FOR METAL-WORKING PLANTS

Faster Production



Speedy, localized induction heating cuts heating time to seconds.

Often eliminates copper-plating, packing, carburizing, straightening and extra machining operations.

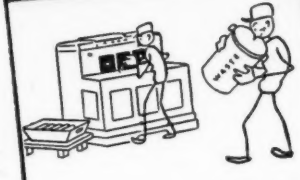


Compact, clean machine can be located close to related operations to avoid hauling.

Set-up changes for different parts are easily and quickly made.

Lower Costs

Slashes man-hours. Skilled labor not required.



Banishes rejects due to distortion. Saves wear on dies caused by scaling in forming applications.

Often eliminates need for costly alloys in product.

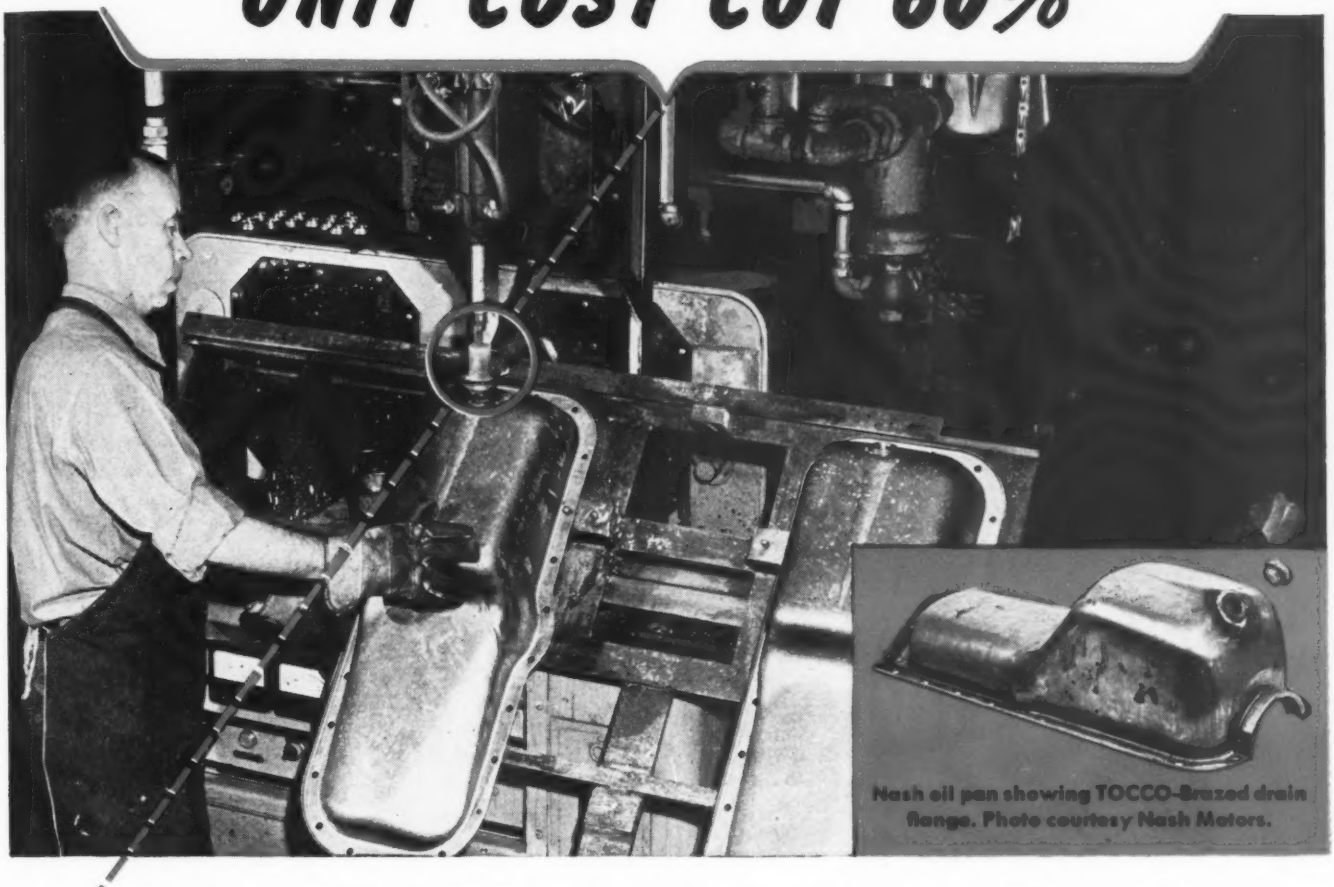
Saves floor space. Improves working conditions.

with TOCCO* Induction Heating

IF you are concerned with the profit and loss figures of your company don't overlook the cost-cutting possibilities of TOCCO Induction Heating. America's leading metal-working plants have found that TOCCO can speed production and lower unit costs in hardening, heating for forging and brazing applications.

Look how NASH did it

PRODUCTION TRIPLED! UNIT COST CUT 60%



Nash oil pan showing TOCCO-Brazed drain flange. Photo courtesy Nash Motors.

with TOCCO* Induction Heating

Even if your products are entirely different in size and shape TOCCO can probably provide similar cost reductions and production increases for you.

● *Nash Motors,* Kenosha, Wisconsin reports the following benefits from TOCCO Induction brazing of drain flanges to automobile oil pans:

1. PRODUCTION TRIPLED— Using a hand torch, production was only 21 brazed assemblies per hour. TOCCO brazes 75 per hour—357% of former output!

2. COSTS CUT—At the same time TOCCO Induction brazing cuts labor and material costs from $12.75 to $4.90 per hundred—a reduction of 60%, representing a saving of $6.00 every hour.

3. OTHER ADVANTAGES—include a neater, better looking brazed joint, and a complete elimination of leakers and subsequent repair costs.

TOCCO Engineers are glad to help you find applications in your plant where TOCCO Induction Heating can increase your production, cut your costs and improve your products.

THE OHIO CRANKSHAFT COMPANY

TOCCO

*Trade Mark Reg. U. S. Pat. Off.

Mail Coupon Today

FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-2, Cleveland 1, Ohio

Please send free copy of 40 page book "TOCCO Induction Heating"

Name _____

Position _____

Company _____

Address _____

City _____ Zone _____ State _____

NOW CHROMIUM PLATED FOR LONGER SERVICE LIFE

Another BIG STRIDE in *Extra* SERVICE

Chromium Plated

STANDARD **DuBo*** **PLUG GAGES**

SINGLE END
Size 1.510" (38mm) and over

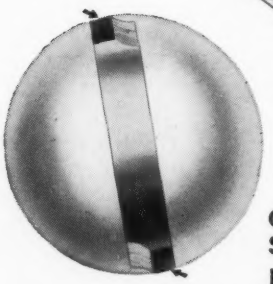
DOUBLE END
Under 1.510" (38mm)

DuBo Plug Gages have already won an excellent reputation for long-enduring service. Exceptionally long wearability is inherent in their basic design. *Now chromium plated gaging surfaces, available at very little extra cost, add a tremendous plus to their service life.*

For long runs and the more abrasive materials specify *Chromium Plated* DuBo Gages.

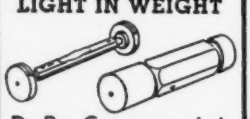
Be Sure To Write For DuBo Bulletin

*Patents Pending



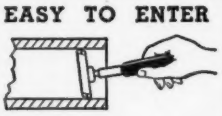
GAGING SURFACES are portions of a sphere

LIGHT IN WEIGHT



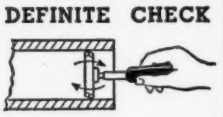
DuBo Gages weigh 70% to 80% less than cylindrical plug gages of equivalent size.

EASY TO ENTER



Simply tip handle slightly above bore axis. Enters even undersized bores easily.

DEFINITE CHECK



Whether or not handle drops freely below center is definite yes-or-no answer.

STANDARD GAGE CO., INC.

Poughkeepsie, N.Y.

THE GREENFIELD STORY
of Service and Quality

"Built-In"

THE tap is not a tool whose value can be told by its looks. It is only in its performance that its merit becomes manifest. If it threads thousands of holes at high speeds with undeviating accuracy, it is a good tap. Its true value is built into it by the maker in his selection of steel, his workmanship, and his refinements of design that are rarely visible to the eye. There is, we believe, still another important "built-in" value in "Greenfield" taps. It is the service which is available to the tap user from the distinguished list of distributors who stock the "Greenfield" line from coast to coast; and the on-the-spot help which is available from the trained "Greenfield Man" on any threading problem at any time. *Such "built-in" values are an important chapter in the "Greenfield" story of service and quality.*

GTD

GREENFIELD TAP and DIE CORPORATION
Greenfield, Massachusetts

and

GEO MET RIC

THE GEOMETRIC TOOL CO.
New Haven 15, Connecticut

and

GTD AMPCO

AMPCO TWIST DRILL CORP.
Jackson, Michigan

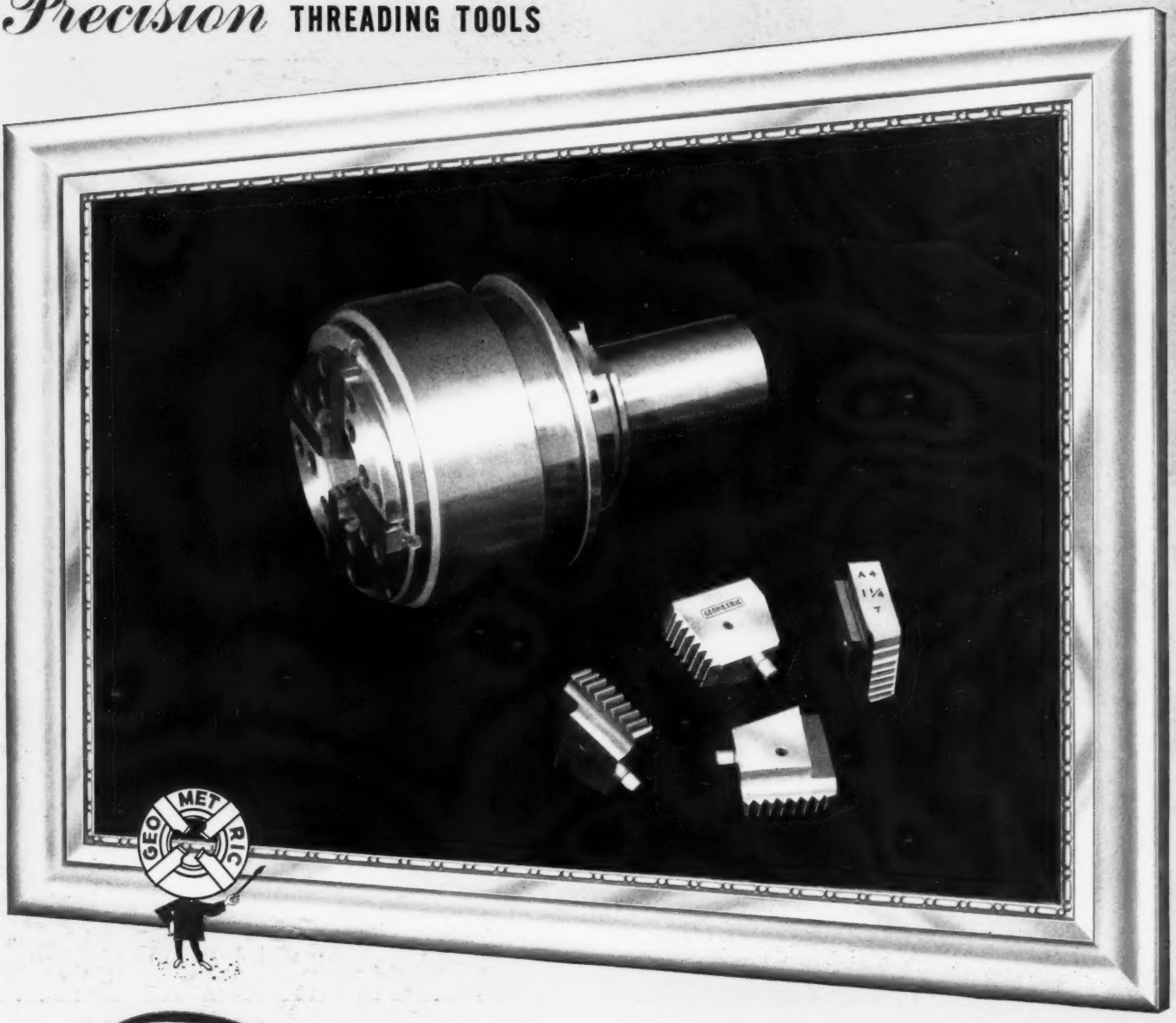
Divisions of Greenfield Tap and Die Corporation

GTD

GREENFIELD

Be Sure
Buy "Greenfield"

Precision **THREADING TOOLS**



Rotary Style KD Die Head and Chasers

This Self Opening Die Head is for use on live spindle machines, particularly automatic screw machines.

★ ★

Available in six sizes, with a cutting range from 1/16" to 2½".

★ ★

GEOMETRIC also makes a complete line of Self Opening, Stationary and Solid Adjustable Die Heads — and Collapsing and Solid Adjustable Taps. *Write today for further details.*

"Be Sure . . . Buy Geometric"

THE
GEOMETRIC
TOOL COMPANY, NEW HAVEN 15, CONNECTICUT

Division of Greenfield Tap and Die Corporation

GTD GREENFIELD TAP and DIE CORPORATION
Greenfield, Massachusetts

GTD AMPCO AMPCO TWIST DRILL CORPORATION
Jackson, Michigan
Division of Greenfield Tap and Die Corporation

A

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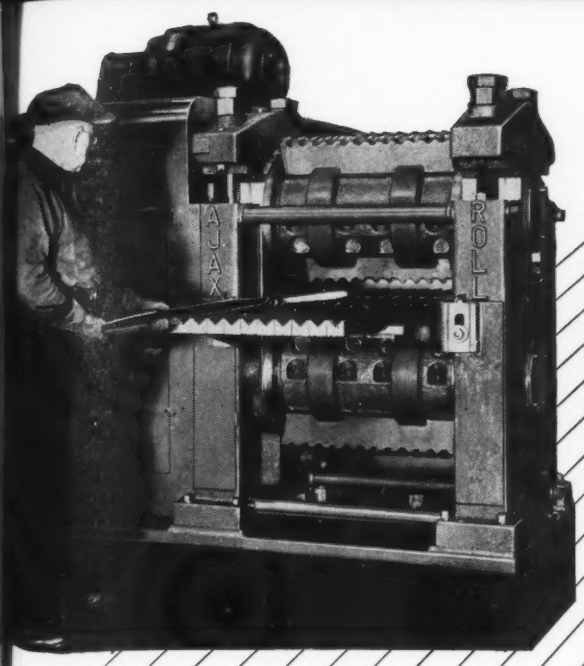
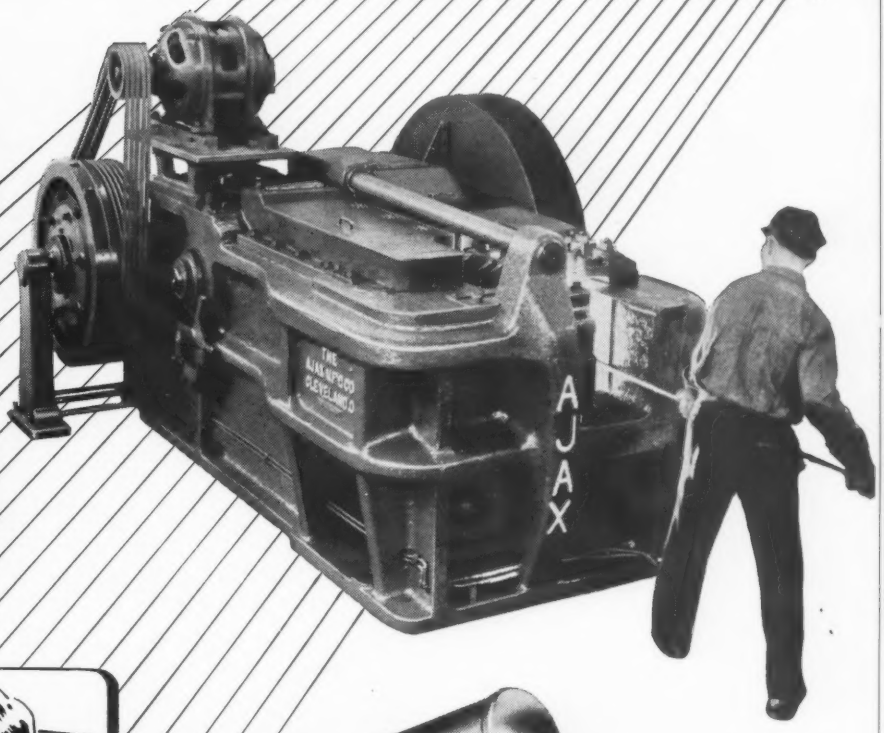
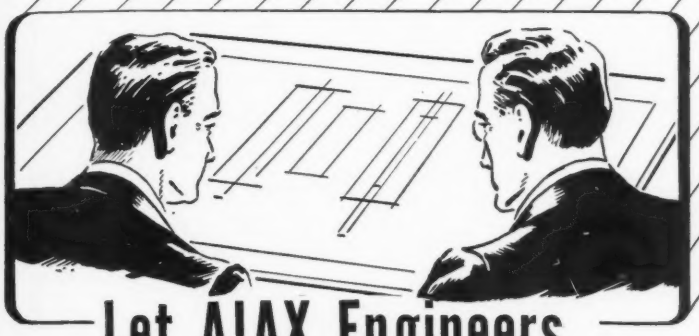






Let AJAX Engineers Aid You In Selecting *Forging Machinery*

Ajax engineers, thoroughly experienced in forging processes and forging machinery, can be of valuable assistance to the persons responsible for efficient forging production.

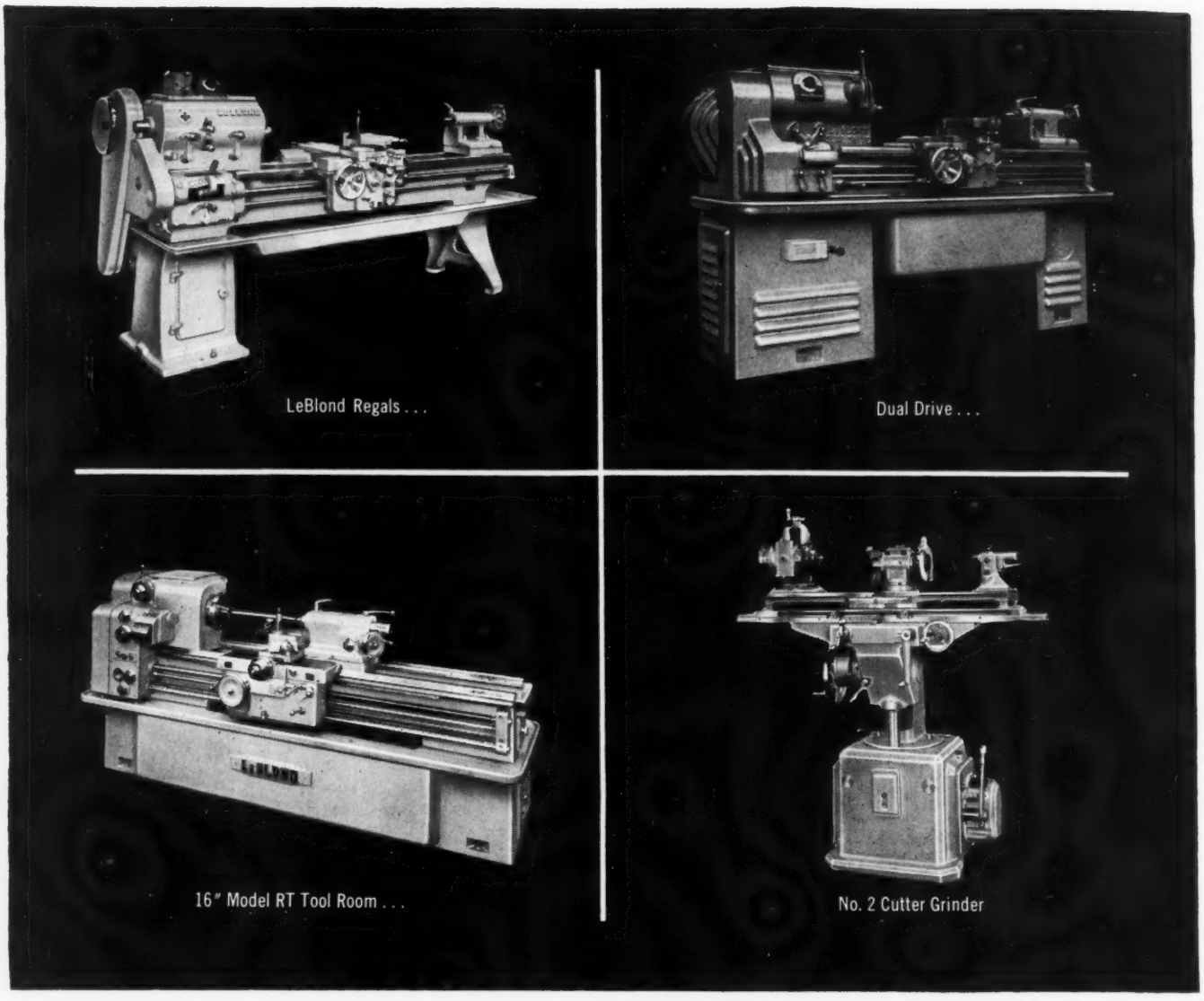
The Ajax Manufacturing Company manufactures a complete line of forging machinery - - - Forging Machines, Forging Presses, Forging Rolls etc. Ajax engineers, with the knowledge gained through research and development within their plant and through constant contact with the most progressive forge plants in the country, are experts in the field of forging. Whether your problem concerns the selection of one piece of forging machinery for the forging of a single part, or a multiple unit production line set-up from bar stock to the trimmed forging, Ajax engineers will welcome the opportunity to assist you wherever possible.

THE AJAX MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND 17, OHIO

110 S. DEARBORN ST. CHICAGO 3, ILLINOIS

DEWART BUILDING NEW LONDON, CONN.



Low cost precision performance in the production tool room calls for LeBlond lathes and cutter grinders

FOR COMPLETE INFORMATION on why these modern LeBlond lathes and cutter grinders should be in your tool room, send today for any or all of the following free bulletins:

- ☐ REGALS . . . made in 6 swing sizes: 13", 15", 17", 19", 21" and 24".
- ☐ DUAL DRIVE . . . Bulletin No. 2.
- ☐ RT TOOL ROOM . . . Bulletin RT-31.
- ☐ No. 2 CUTTER GRINDER . . . Bulletin CG-251.

THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES.
SALES OFFICES: New York, Chicago, Philadelphia, Detroit.

LEBLOND

The Foreman of this progressive shop (left) consults with a Gulf Lubrication Engineer on results with Gulf L.S. Cutting Base in machining clock parts.

Costs Down-Production Up!

"We've sharply reduced time per piece, improved surface finish, and greatly extended the number of pieces per tool grind since we switched to Gulf L.S. Cutting Base," says this Foreman of Main Screw Machine Products, Inc., Waterbury, Conn.

"On our new ¾" automatics we are performing two turning, one threading, and one cut off operation on a steel clock part at the rate of 1.2 seconds per piece. With the cutting oil we used previously the time per piece was much higher."

"Just as important to us has been the increased number of pieces per tool grind. With Gulf L.S. Cutting Base we are now running 16,000 pieces before regrinding of the tools is necessary. Add the fact that we are getting better finishes, and you can see why we're gratified by our experience with this fine cutting oil."

Here's another example of how the proper application of the right Gulf quality cutting oil improves production and lower costs. To make sure that you're getting all the benefits possible through the use of more suitable cutting oils, call in a Gulf Lubrication Engineer today.

Gulf Oil Corporation · Gulf Refining Company

Division Sales Offices:

Boston · New York · Philadelphia · Pittsburgh · Atlanta
New Orleans · Houston · Louisville · Toledo

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company M
3800 Gulf Building, Pittsburgh 30, Pa.

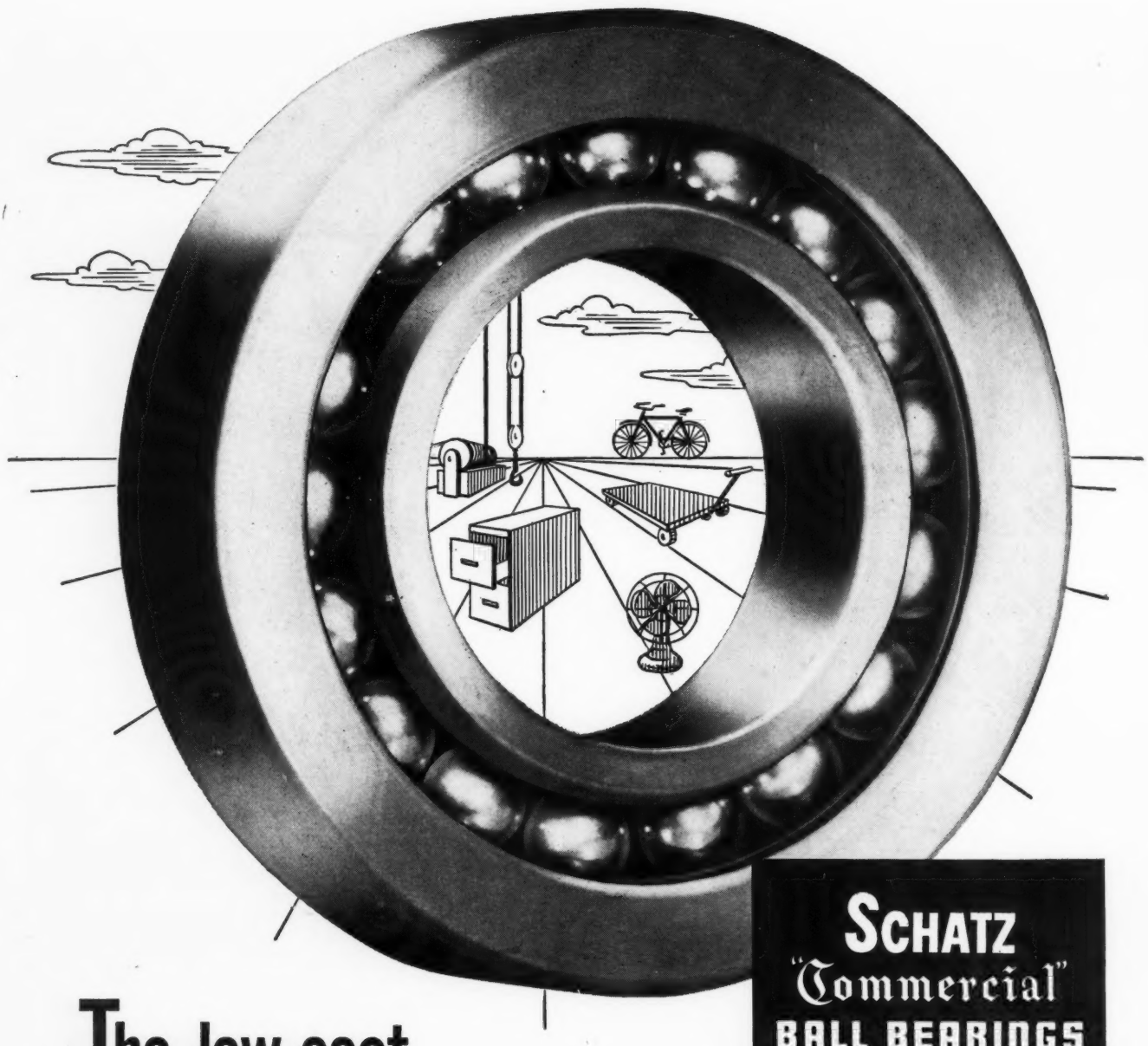
Please send me, without obligation, a copy of your pamphlet "The new improved Gulf L.S. Cutting Base."

Name.....

Company.....

Title.....

Address.....



SCHATZ
"Commercial"
BALL BEARINGS

The low-cost, multi-purpose ball bearing

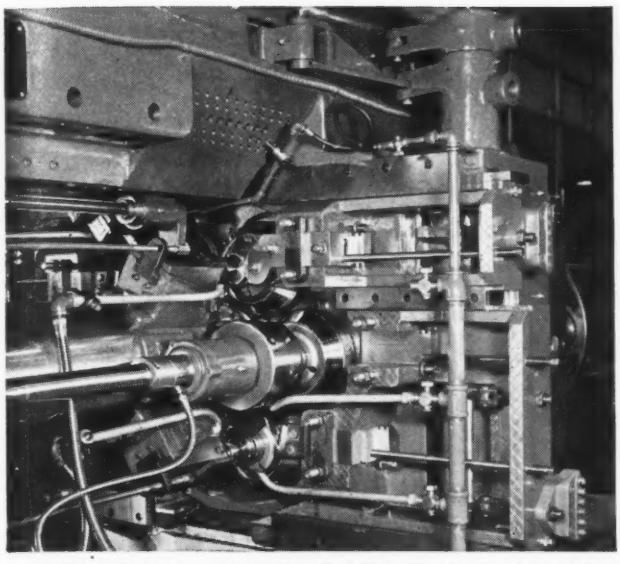
You name the product...hand truck, electric fan, file cabinet, bicycle or *any* application where friction-free performance must be combined with low cost. That's the job for Schatz "Commercial" Ball Bearings. High grade, low-carbon, cold-rolled steel rings and high quality balls give "Commercials" their extra load capacity, and result in longer bearing life and all-around utility.

"Commercials," manufactured in every type and size, are products of over half a century's experience in the manufacture of ball bearings. Schatz engineering counsel will help you adapt "Commercials" to your product. Or, if you need a special type bearing, our engineers will be glad to work with you to design and make the right bearing for your application. Tell us about your bearing problem.

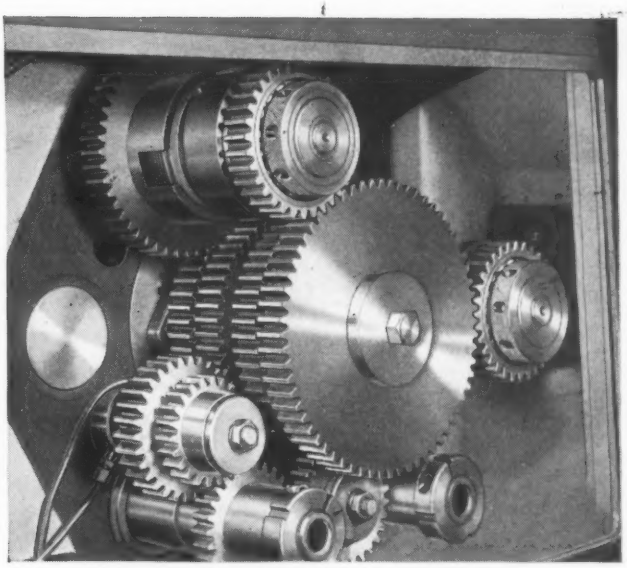
Equipment moves freely on Acme Ball Bearing Casters

Acme Ball Bearing Casters *roll on balls* —not wheels, provide a free-rolling "bearing" action on conveyors and other heavy equipment that must be shifted around...in all directions. Acme Casters are strong, durable and efficient on *any* type floors. They're available in several types and sizes for many industrial applications. Write for details.

THE SCHATZ MANUFACTURING COMPANY
6754 FAIRVIEW AVE., POUGHKEEPSIE, N. Y.
REPRESENTATIVES LOCATED AT
2640 Book Tower, Detroit 26, Mich.
402 Swetland Bldg., Cleveland 15, Ohio
8 South Michigan Avenue, Chicago 3, Ill.



Full Swing for Main and Auxiliary End Slide Standard and Special Tool Mountings



Cone "Full-Choice" Open End Attachment Drive

IS HALF A LOAF BETTER THAN ONE?

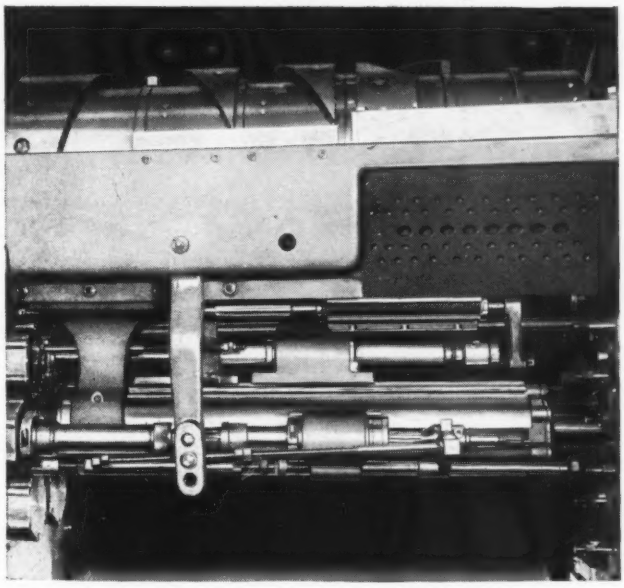
Machine capacity can usually be measured by tooling accommodation. The facility available to handle the job will determine a machine's dollar value.

Lack of a "full choice" accommodation of tooling positions for endworking tools and attachments can be a costly handicap to a multiple spindle automatic. The inability to swing to full collet capacity die heads, hollow mills, trepans, and internal necking tools, can limit a machine's usefulness on many jobs from zero up. Like half a loaf — better than none, but much less than one.

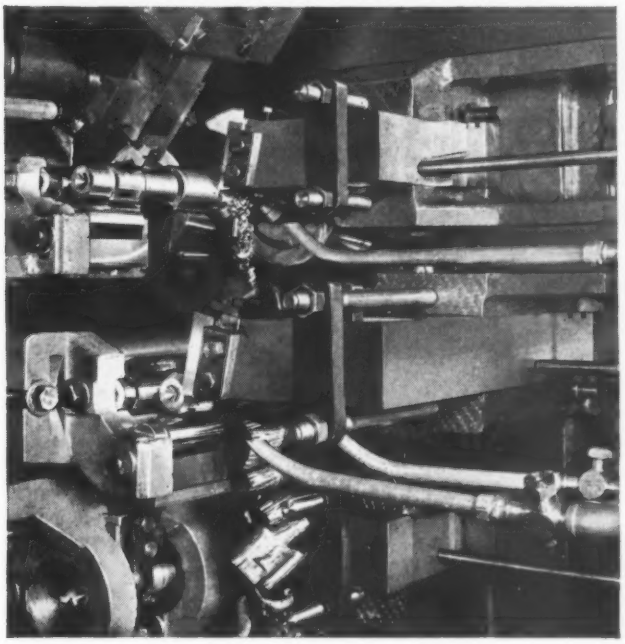
The "full choice" tooling accommodation of Conomatic cross slides, main end slides, auxiliary end slides and endworking attachment drive positions, are worth checking.

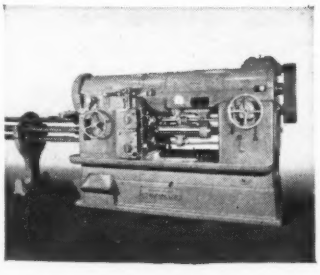
Write to Cone for Buyer's Chart which lists overall requirements of Multiple Spindle Automatics.

"All-Position" End Attachment Mounting



Standard Forming Slide and Auxiliary Cross Slide Facility



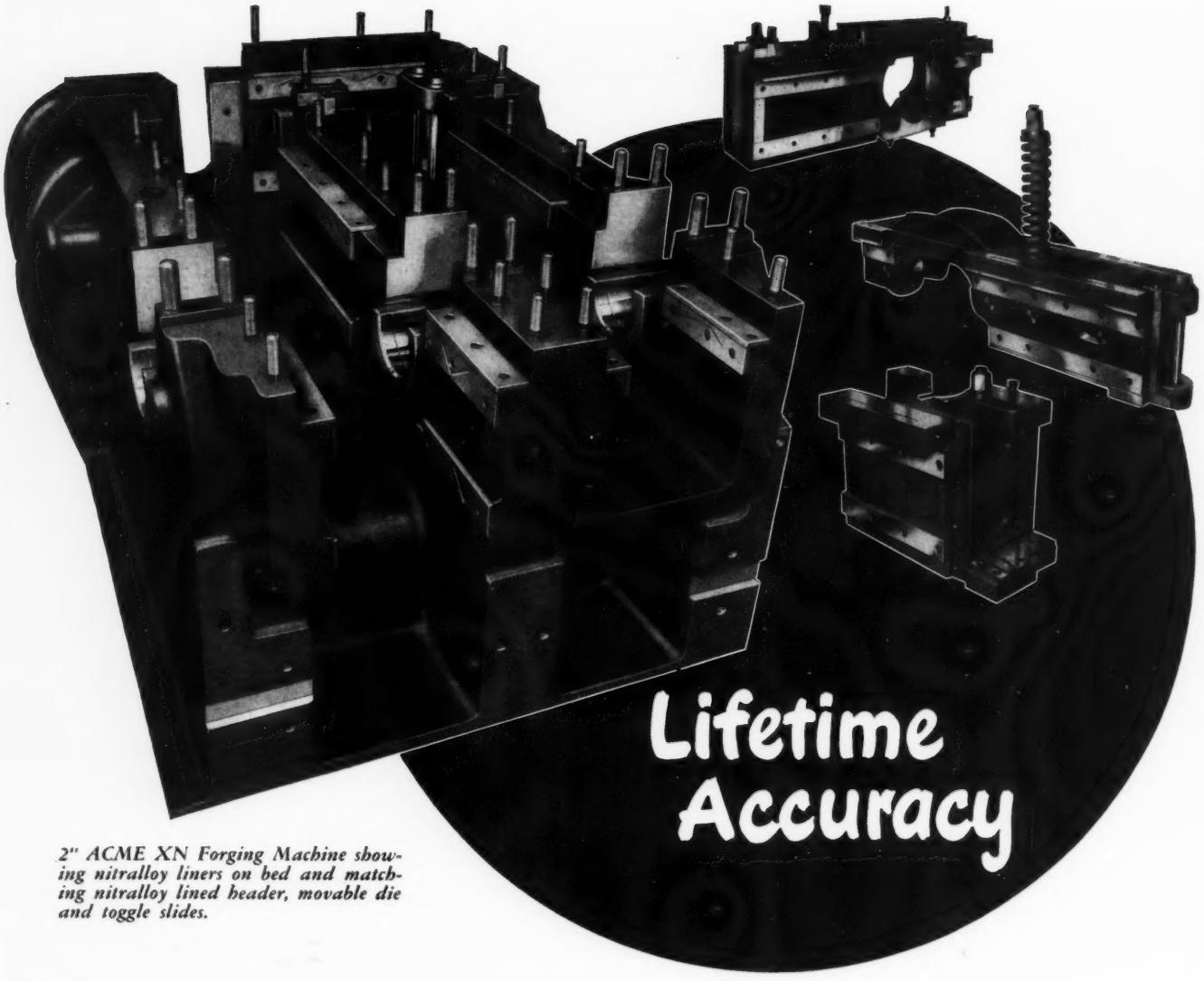


A comparison with ALL Automatics will lead you to

#6

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

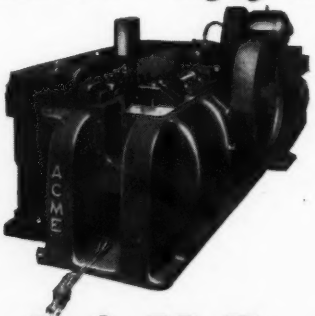


2" ACME XN Forging Machine showing nitralloy liners on bed and matching nitralloy lined header, movable die and toggle slides.

HILL ACME TOOLS FOR INDUSTRY

Nitralloy liners, used on all slide ways of ACME Model XN Forging Machines, just don't wear out. Ten years under all kinds of actual operation have proven that the slide ways protected by nitralloy liners retain their alignment permanently and insure continuous peak performance of ACME XN Forging Machines.

The other advantages of these modern forging machines are fully described in bulletin 57 giving details on 1¼", 1½" and 2" sizes. Bulletin 77 describes 2½", 3", 4" and 5" sizes.



THE HILL ACME COMPANY

ACME MACHINERY DIVISION • **4535 St. Clair Ave., Cleveland 14, Ohio**
ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

131% DIVIDEND

IN ONE YEAR*

The Messinger Mfg. Co., Tatamy, Pa., makers of Insecticide Dusters, Threshers, Corn-Shellers and Woodworking Machinery are reaping the benefits of Turret Lathe Productivity.

131% of the funds invested in Jones & Lamson Turret Lathes were repaid to the purchaser in one year of operation.

* Both large and small lot production of sheaves, bearing caps, blowers, blower cases, worm gear housings, etc., are now turned at peak economy on Jones & Lamson Universal Turret Lathes. One year's savings, based on direct costs alone, more than paid for three machines complete with equipment!

Messinger Mfg. Co., famous for over 90 years' experience in producing agricultural implements, reports that six obsolete lathes were replaced — with capacity to spare. Savings were due to carbide tooling, to the elimination of second operation arbor work (accurate bored jaws were faster and easier) and to the ability of the new machines to hold and repeat exact size settings by means of multiple stops.

Even if your present machines are less than 10 years old, the purchase of a new Jones & Lamson Turret Lathe may be justified through *direct savings alone!* Let us determine YOUR possible savings. **Write to Dept. 710H for this free service.**

Turret Lathe Division

JONES & LAMSON MACHINE COMPANY
Springfield, Vermont, U.S.A.

MACHINE TOOL CRAFTSMEN SINCE 1835

Choosing the Right Stock Drill

- **Cuts Your Cost Per Hole**
- **Eliminates Breakage**
- **Speeds Production**

Yes, there are many advantages in selecting the right drill for each job. For instance, one of our customers was getting excessive breakage with regular jobbers' length drills on the set-up pictured here—drilling holes 7/16 inch deep in stainless steel. A *Cleveland* Service Representative was able to correct this situation by recommending a stub screw machine drill which, because of its heavier construction and shorter length, is giving complete satisfaction. *Your* drilling problems, too, perhaps can be solved by a *Cleveland* Service Representative—without cost or obligation. Contact our nearest Stockroom, or . . .

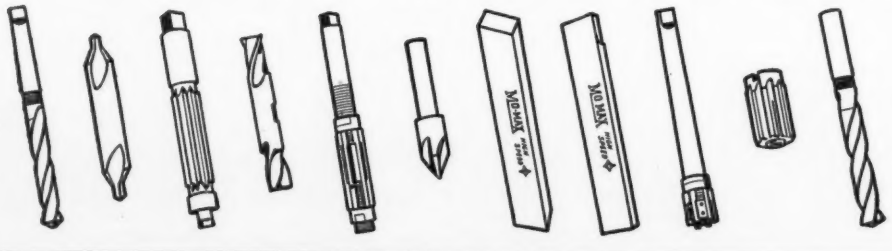
Telephone Your Industrial Supply Distributor

CLEVELAND

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street **Cleveland 14, Ohio**
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 1 • San Francisco 5
Los Angeles 11 • London W. 3, England

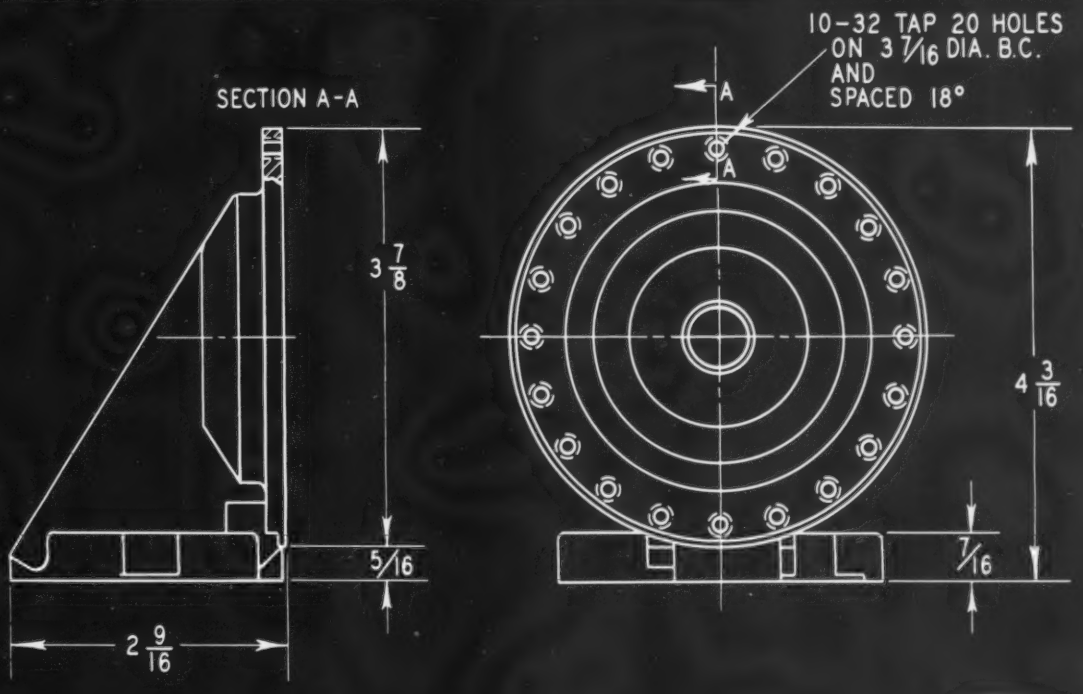
ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER CLEVELAND TOOLS



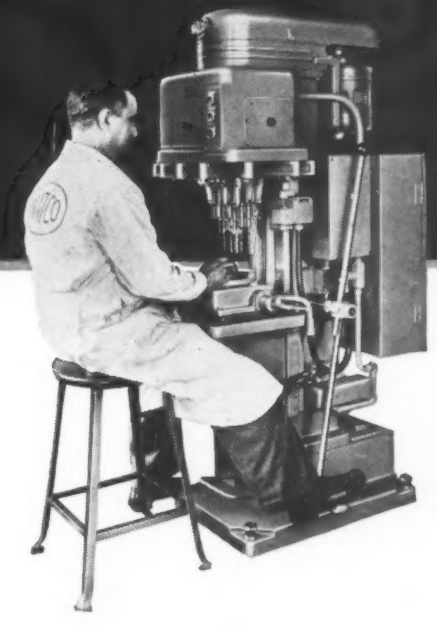
"CLEVELAND" DISTRIBUTORS EVERYWHERE
are ready to serve you!

PRODUCTION INCREASED 100% over Previous Method

with NATCO High Speed Sensitive Drilling and Tapping Machine



Part—Die Cast Diaphragm Cover
Operations—Tap Ten 10-32 Holes
Index
Tap Ten 10-32 Holes
Production—Approximately 300 Parts Per Hour



NATCO A33 Multi-Spindle Machines are built specifically to help you obtain more economical high speed, light sensitive drilling and tapping operations in your plant. They make possible remarkably high production and low hole cost in a wide range of small and medium sized work. Whether your production involves drilling and tapping operations in cast iron, in steel, in aluminum, in plastics or in wood, NATCO welcomes your inquiry and suggests that you send prints wherever possible. Write today! Department M.

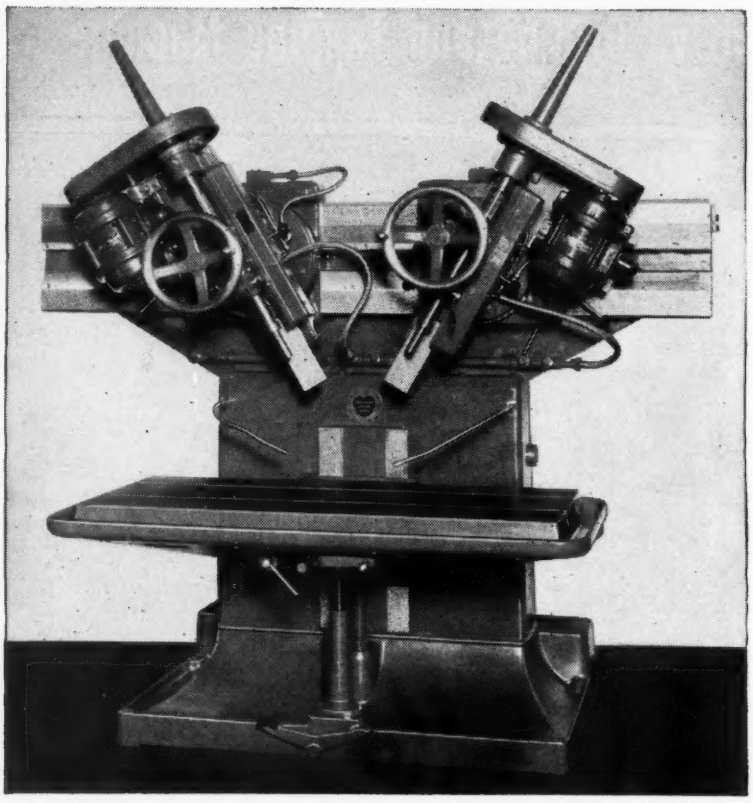
NATCO DRILLING, BORING, TAPPING AND FACING MACHINES

NATCO

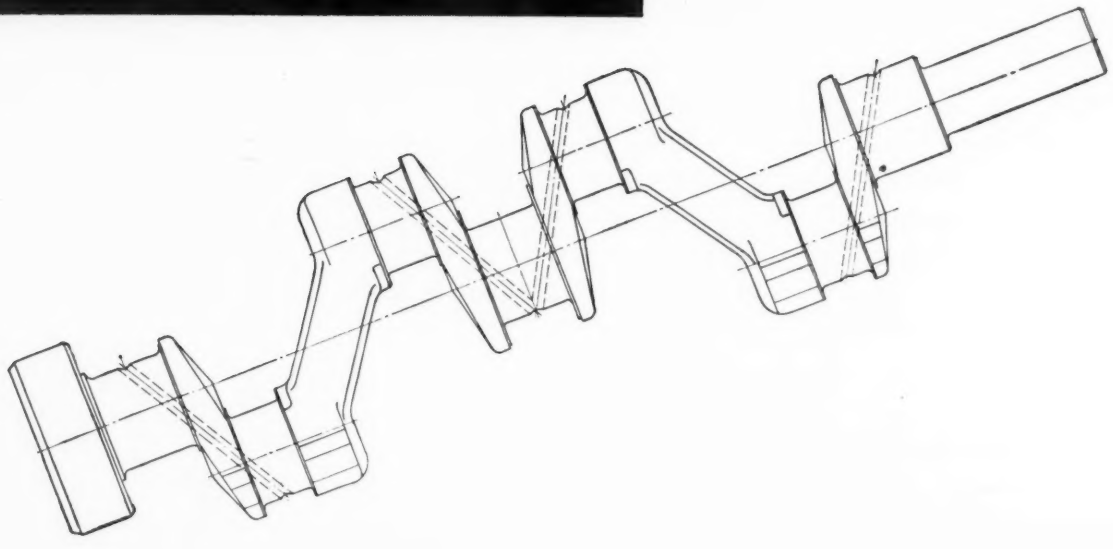
NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Ind., U. S. A.
Branch Offices: 1809 Engineering Bldg., Chicago • 409 New Center Bldg., Detroit • 1807 Elmwood Ave., Buffalo • 2902 Commerce Bldg., New York City

Call a Natco Field Engineer

LELAND-GIFFORD



UNIVERSAL RAIL TYPE DRILLING MACHINE



- A handy machine for drilling angular oil holes in crankshafts.
- Exceptionally efficient for small lot production or for special designs and experimental parts.

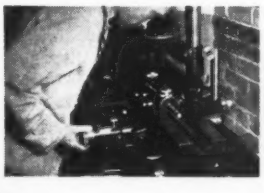
LELAND-GIFFORD

WORCESTER 1, MASSACHUSETTS, U. S. A.

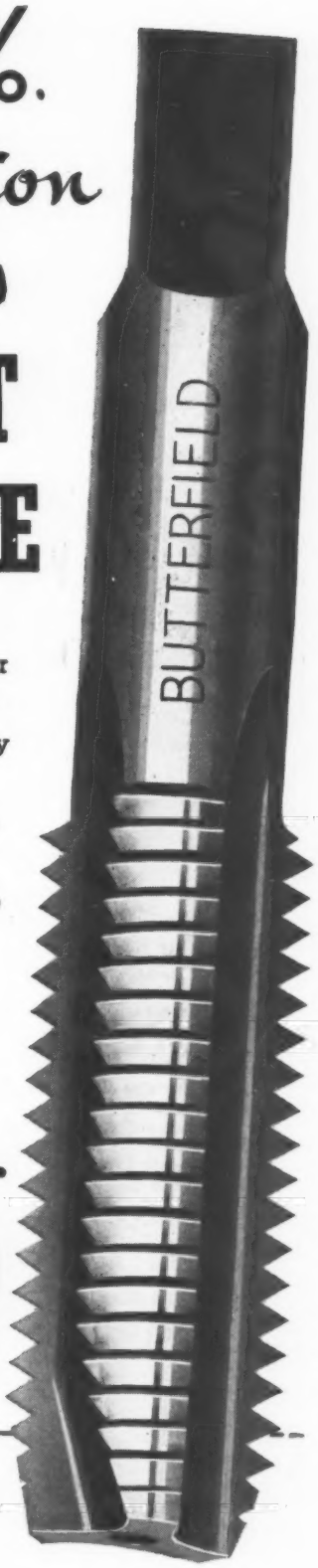
Only **100%.** *inspection insures* **PERFECT PERFORMANCE**

ONLY when cutting tools have been given 100% inspection can you be *sure* of their top performance on the job. That's why every Butterfield spiral pointed tap is thoroughly checked so that it comes to you ready for your toughest assignments. Spiral pointed taps are designed for tapping deep through holes or blind holes drilled deeply enough to allow chip clearance at the bottom of the hole. They cut freely . . . produce excellent threads.

You can get quick deliveries of spiral pointed taps and other cutting tools from your nearby Butterfield Distributor ...he'll be glad to help you select the right tool for the job. BUTTERFIELD DIVISION, Union Twist Drill Company, Derby Line, Vermont, and Rock Island, Quebec.



Checking Pitch Diameter, Thread Form and Lead on a Zeiss Universal Measuring Microscope



BUTTERFIELD

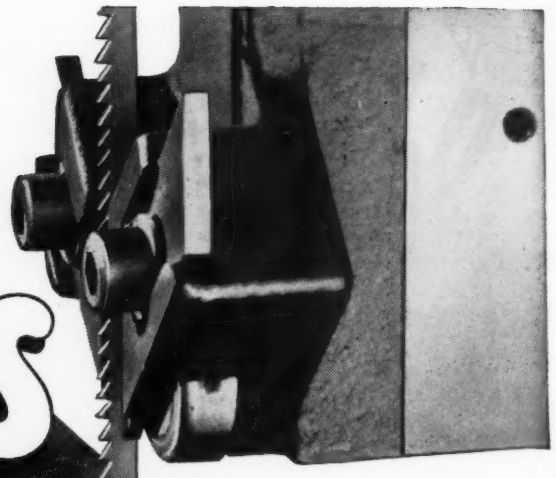
THE 100% INSPECTED TOOLS

Every Tool Individually Inspected

TAPS • DIES • REAMERS • SCREW PLATES

Specify SIMONDS METAL-CUTTING BAND SAWS

for Smoothness . . . Strength . . . Service



These three types of Simonds Band Saws . . . made from special Simonds steel . . . with evenly set, milled teeth . . . will do any bandsawing job for you faster and better, at lower cost:

Regular Hard-Edge Band Saws: For speed-cutting alloy steels and other ferrous metals. 8 widths and tooth sizes, for general and contour cutting.

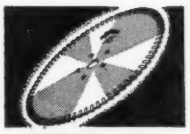
Skip-Tooth Band Saws: For speed-cutting plastics, aluminum, magnesium and other soft, non-ferrous materials which require extra gullet-capacity to clear large chips. 4 widths and tooth sizes.

Spring Temper Band Saws: For speed-cutting thin aluminum sheets, magnesium and steel . . . as well as light structural shapes, plastics, fibre, etc. 7 widths and 5 tooth sizes.

Extra Savings: Don't divert your millers, shapers, lathes and drills to work that Simonds Band Saws can do *better and faster!*

And don't overlook the opportunity to save by making your own gages, templates, etc., from Simonds Flat Ground Steel Stock cut by Simonds Metal Bands . . . a top money-saving combination. Ask your Distributor.

SIMONDS ALSO MAKES:



CIRCULAR METAL-CUTTING SAWS (Solid-Tooth, Inserted-Tooth, Segmental)

FLAT GROUND STEEL STOCK (Oil Hardening)

"RED TANG" FILES

"RED END" HACKSAWS

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.
Other Divisions of SIMONDS SAW AND STEEL CO. making Quality Products for Industry

Special Electric Furnace Steels — Grinding Wheels and Grains — Simonds Products for Canada

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Avenue, Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Wash. *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.

SIMONDS METAL-CUTTING BAND SAWS

REGULAR HARD EDGE . . . SKIP-TOOTH HARD EDGE . . . AND SPRING TENSION SAWS

WHEN YOU USE SIMONDS YOU STAY IN THE HIGHLANDS . . . OF CONSISTENT CUTTING EFFICIENCY

How to cut costs with the NEW ROTOR 360 CYCLE TOOLS

THE new Rotor 360 Cycle Tools develop nearly twice the power of 180 cycle tools with the same size motor and develop *more power per pound* than any other type of portable tool.

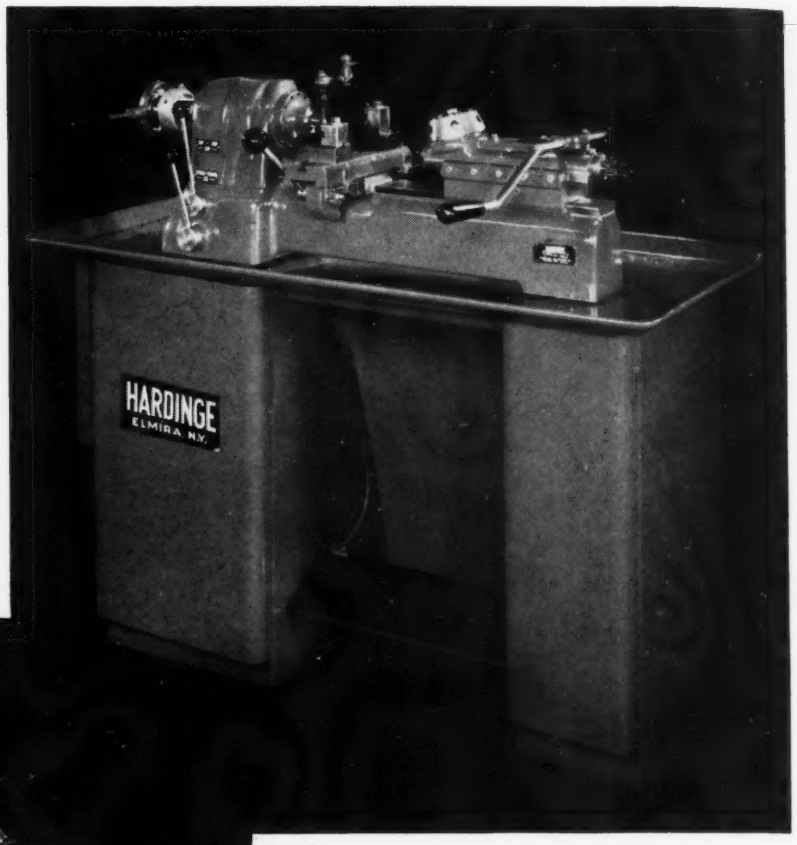
The 6-inch, 360 Cycle Rotor Grinder shown weighs only 12½ lbs., operates at free speed of 6000 R.P.M. and under full load at 5700 R.P.M. This light weight and high speed under load means *greater production . . . lower costs.*

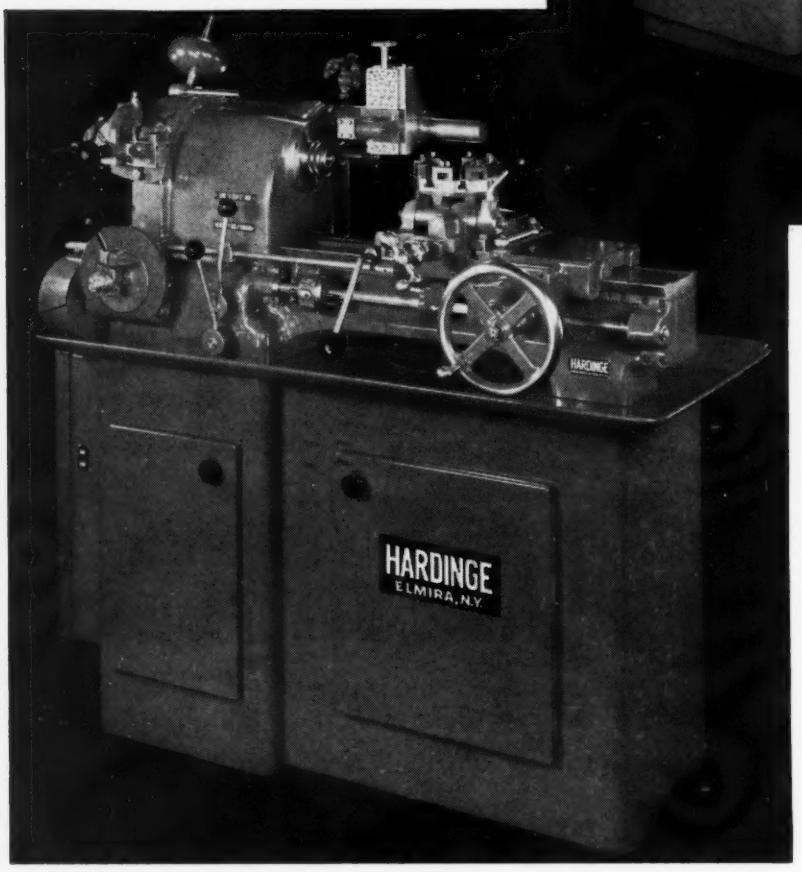
Call the Rotor Analyst for full information on this remarkable new line of Rotor grinders, sanders, buffers and polishers. Write for free copy of Bulletin 36.

360 CYCLE O'TOOL

HARDINGE
ELMIRA, N.Y.

HIGH SPEED
PRECISION PRODUCTION MACHINES





SECOND OPERATION MACHINE: 1" collet, 6" step chuck, 5" jaw chuck capacity; eight spindle speeds to 4000 r.p.m.; preloaded ball bearing construction for spindle and turret; hardened and precision ground steel ways; turret and cross slide operating levers are adjustable to suit the operator.

Write for descriptive bulletin DSM59.

MULTI-OPERATION CHUCKING MACHINE: This machine has the same capacity as the Second Operation Machine. In addition, it has an eight-position turret, production threading head and power feed for the carriage.

Write today for bulletin HP which shows how this machine can handle various jobs, using standard tool bits only . . . for low-cost tooling.

The production of precision parts today requires tool room accuracy with high speed operation to reduce and then maintain lower costs. The above machines are both designed to increase the output of parts to extremely close tolerance and finish specifications. The precision qualities of these machines, combined with the simplicity of operation, assure lower costs.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

OFFICES IN PRINCIPAL CITIES. EXPORT OFFICE, 269 LAFAYETTE ST., NEW YORK 12, N. Y.

When you choose Card cutting tools...

INDEPENDENT LABORATORY TESTS HELP KEEP YOUR TOOL COSTS DOWN

TAPS

The Certified Cutting Tools*

*by the Pittsburgh Testing Laboratory

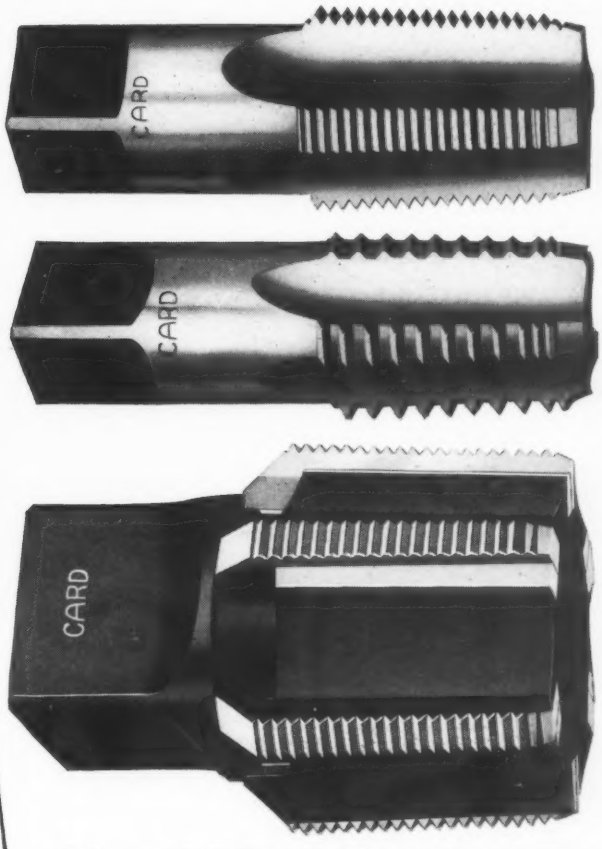
Also makers of DIES • SCREW PLATES
DIE STOCKS • TAP WRENCHES

WHEN our tool inspectors put their "OK" on Card cutting tools we don't take their word for it!

Although we make Card tools meet the highest standards in factory inspection, we've engaged the famous Pittsburgh Testing Laboratory to make independent tests of our taps which they buy on the open market . . . just as you do. The results of their tests for hardness and dimensional accuracy are then *certified*.

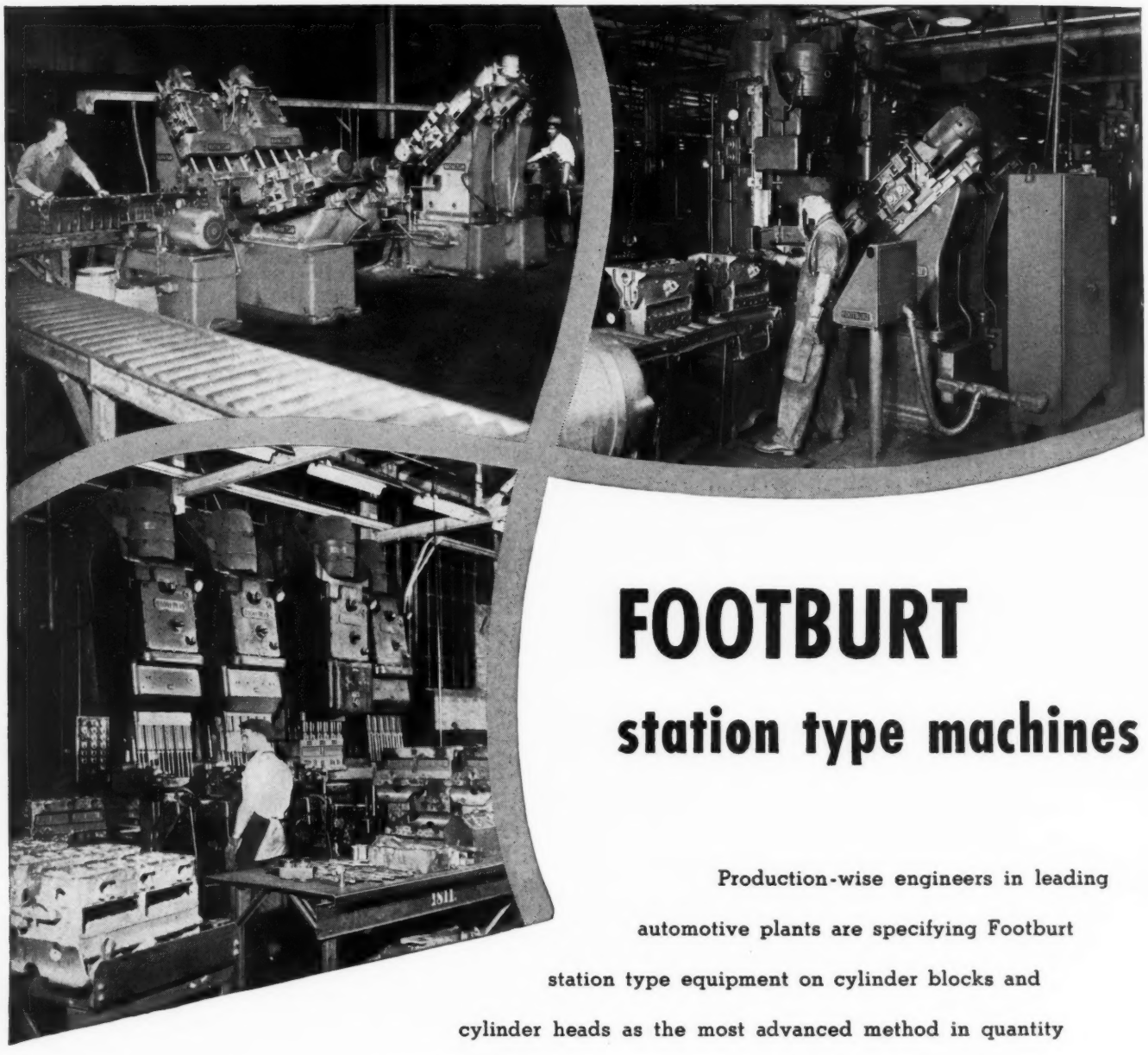
This means that when you invest in a Card tap, you've got that *extra assurance* of quality that means top performance on the job.

And for prompt service . . . your nearby Card Distributor is set up to fill your needs to perfection.



S. W. CARD

MANUFACTURING COMPANY
Mansfield, Massachusetts
DIVISION OF UNION TWIST DRILL CO.



FOOTBURT

station type machines

Production-wise engineers in leading automotive plants are specifying Footburt station type equipment on cylinder blocks and cylinder heads as the most advanced method in quantity manufacturing. Similar operations that ordinarily require several separate machines are grouped in one station machine thus greatly reducing handling and providing better production control. Combining of valve hole operations, cylinder boring, the majority of drilling and the majority of tapping are outstanding examples of this latest production trend.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

Detroit Office: General Motors Building

FOOTBURT MACHINE TOOLS *Engineered* FOR PRODUCTION

What's in
VERMONT
this month?

EMERGENCY CHANGEOVER WITH BRYANT GRINDERS

The metalworking industry is plagued with the thought of an emergency changeover, a changeover from one product to another — a changeover that requires new machine tools and new tooling.

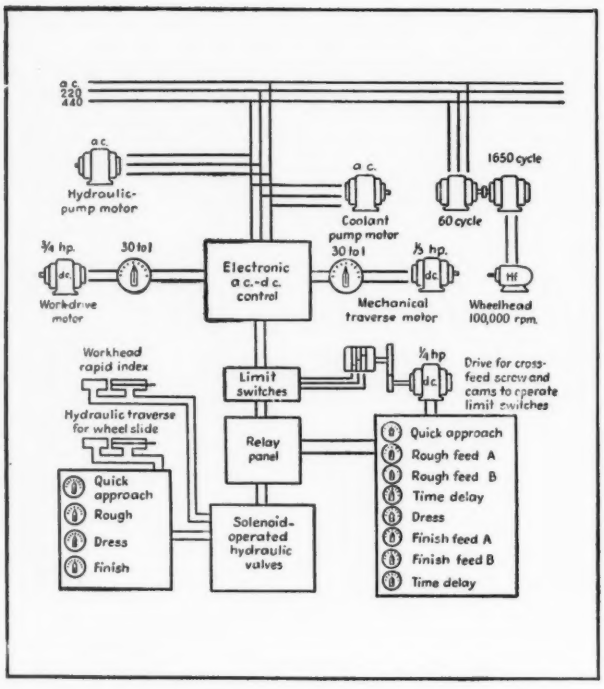
Present day requirements demand fully automatic machines which as a rule do not lend themselves to rapid changes.

If you have a hole-finish problem which could use a fully automatic internal grinder you can purchase it today with full confidence that it will fit into the new production line in the shortest possible time. The Bryant Internal Grinders lend themselves to quick changeover. The fully automatic cycle can be changed in a matter of minutes and Bryant engineers are available to help in special fixture design.

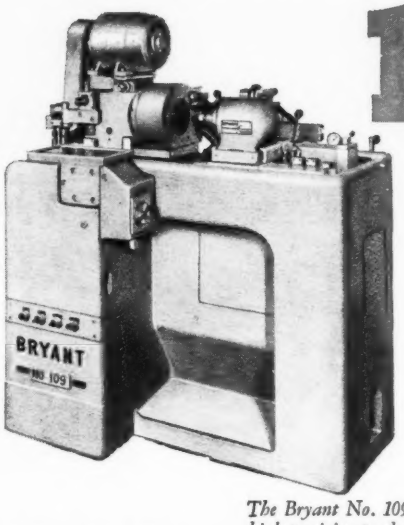
This is an example of how the machine tool manufacturers are ready at any time to see that the American metalworking industry produces the most and the soonest.

It won't cost to inquire.

Bryant Chucking Grinder Co. • Springfield, Vermont, U.S.A.



BRYANT 109



AUTOMATIC INTERNAL GRINDER

The Bryant No. 109 Internal Grinder is designed for high precision production of holes from ¼ to 2½ inches in diameter. Other Bryant equipment will grind holes through the complete range up to 60 inches diameter swing. Write to the factory for full information.

SPECIFICATIONS

Total swing	9 inches
Will grind bore diameters	¼ to 2 ½ inches
Maximum traverse	6 inches
Maximum hole depth	3 inches
Will grind included angle	90°
R.P.M. of work spindle	200 to 2,400 R.P.M.
Net weight	3,000 lbs.

Floor space — 62 inches x 52 inches (with coolant tank)

SLIDES
Preloaded ball slides for both cross and longitudinal motion.

WORKHEAD
Ball bearing spindle, variable speed electric drive, 200 to 2,400 R.P.M.

WHEELHEAD
Precision ball bearing wheelhead with built-in high-frequency electric motor — speeds up to 100,000 R.P.M.

TRAVERSE
Hydraulic — 4 stations in automatic cycle, each variable — see drawing.

CROSS FEED
Eight variable stations in automatic cycle — see drawing.

POWER
Machine operates from standard AC current.

You can "*See the Difference*" with a BRYANT GAGE

BRYANT INTERNAL & EXTERNAL THREAD GAGES. Bryant thread gages are made in three standard models for the fast, accurate, visual inspection of threaded parts. These models cover the range from ⅜" to 5" internal, and 3/16" to 5" external. Write for Catalog No. G for details.

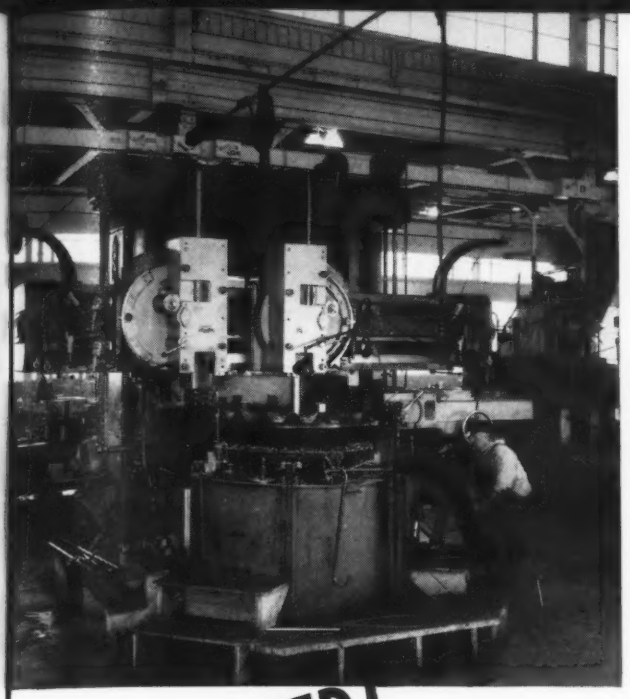
It is no longer necessary to "feel for fit" with plug and ring gages when inspecting threads. The Bryant Thread Gage shows, on a dial indicator, whether a thread will assemble properly with its component.

At a glance, anyone can compare threaded parts with a master and tell the whole story immediately — size, presence of burrs, out-of-roundness, accumulated inaccuracies of pitch, lead, diameter and thread form.

It's fast too. The design incorporates three thread segments, two stationary and one movable. The segments are operated by a thumb lever — the part is dropped between the segments — the lever is released, causing immediate contact of segments to threads — a one third turn of the part inspects it all over.

Send samples or drawings for a complete story on how Bryant can save inspection money for you.

Bryant Chucking Grinder Co. • Springfield, Vermont, U.S.A.



MORE SPEED!
MORE POWER!
MORE PRODUCTION!

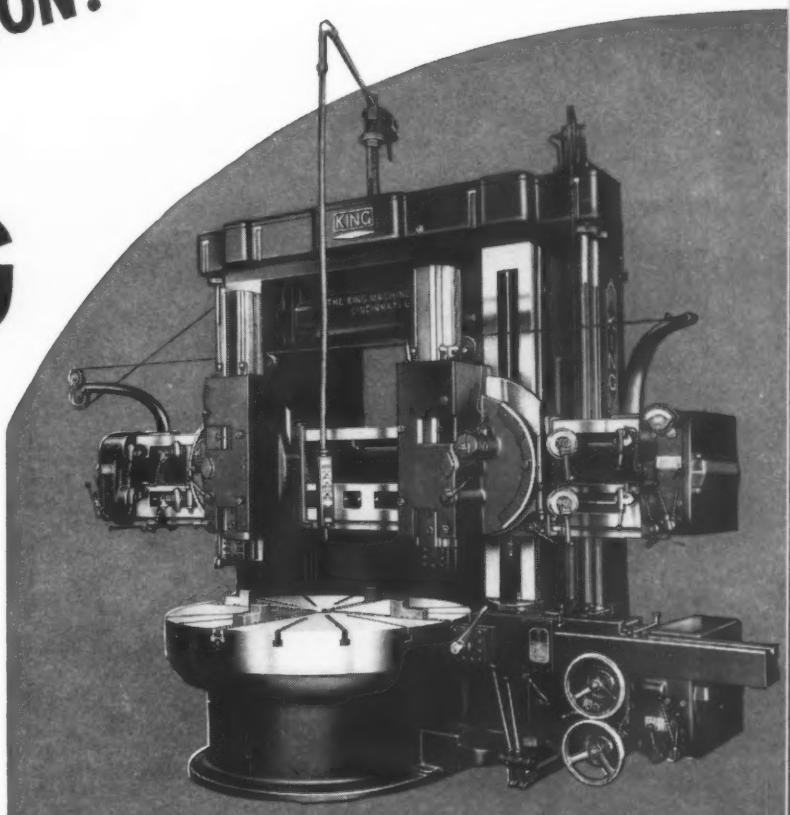
With the New Series KING

VERTICAL BORING & TURNING MACHINES

If your production involves boring, facing, turning, and similar operations, there's a New Series KING that will handle it easier, faster, at less cost.

Because they are substantially HEAVIER, these new KINGS have the rigidity, power, and range of feeds and speeds essential for successful use of carbide tools. New rectangular-type rams have eight bearing surfaces, are fitted with four taper gibs for accurate alignment. Centralized controls save time on the job and *between* jobs.

Call in a KING engineer—let him show you exactly *how* you can save time and improve quality on your boring, facing, and turning work.



New Series KING Machines are made in ten sizes: Single Column, one head on rail, 30", 36", and 42" swing; Double Column, one or two heads on rail, 52", 62", 72", 84", 100", 120", and 144" swing. All available with or without side head. Write for specifications on the size machines that meet your work requirements.

American Steel Foundries

KING MACHINE TOOL DIVISION

CINCINNATI 29, OHIO

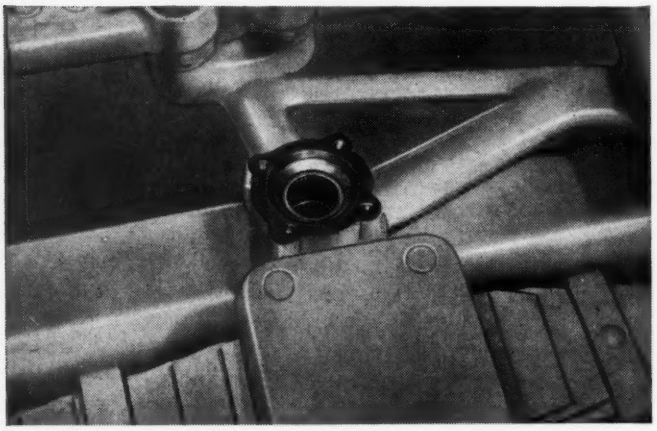
Builders of King Vertical Boring & Turning Machines and Sebastian Lathes

Torrington Needle Bearings

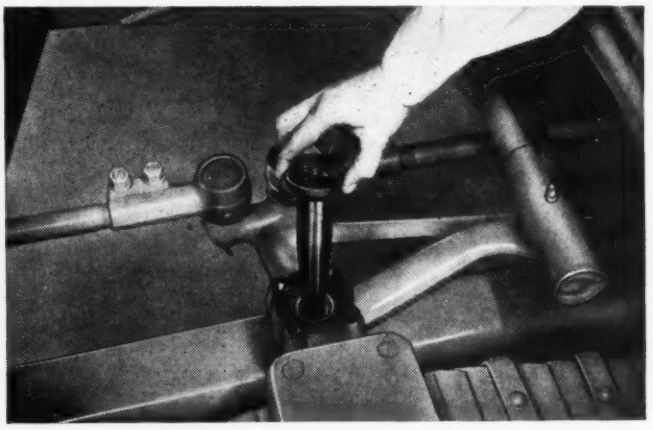
Keep Upkeep Down

in "Caterpillar" Diesel Tractors

Heavy farm chores and tough construction jobs are a matter of course for "Caterpillar" Diesel DW10 Tractors. One feature owners like is a rugged design needing little upkeep. In governor, brake pivot shaft, steering gear and steering bellcrank, long service life is secured with efficient Torrington Needle Bearings.



The bellcrank application in steering control shows how these high-capacity, anti-friction units fit into compact designs. Two Needle Bearings mounted with close fits keep mating parts in alignment. Freedom from wear maintains close bearing clearances and eliminates the need for readjustment.

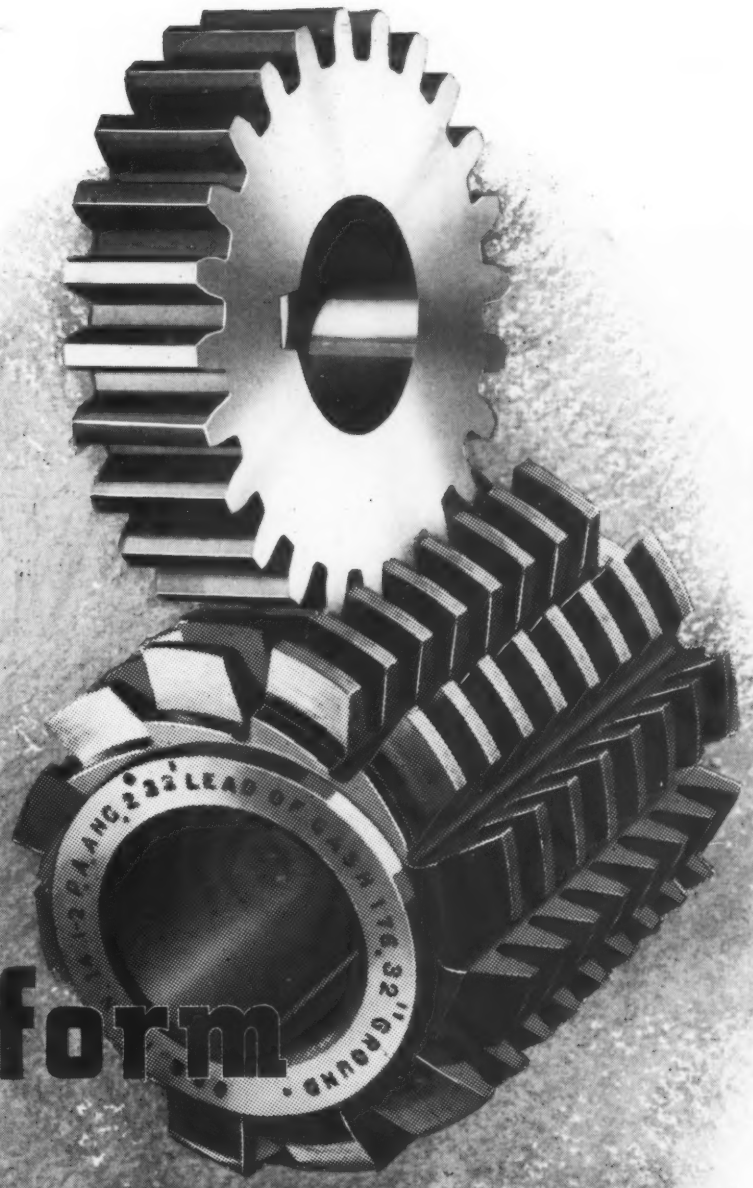


Related parts of the assembly are simple—a plain machined bore for a housing, a hardened and ground shaft for an inner race. Fabrication is easy, and installation a quick arbor press operation. No retaining devices are needed. Such Needle Bearing features help keep manufacturing costs down.

Machinery you build or operate can be improved in operation and service life with Torrington Needle Bearings. Consult our engineers on your specific application requirements. THE TORRINGTON COMPANY, Torrington, Conn. or South Bend 21, Ind. District offices and distributors in principal cities.

TORRINGTON *NEEDLE* **BEARINGS**

Needle • Spherical Roller • Tapered Roller Straight Roller • Ball • Needle Rollers



no other hob will outperform a UNION

See Catalog R
for various types of hobs

contact your local distributor

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

MILLING CUTTERS • GEAR CUTTERS • TWIST DRILLS • HOBS • REAMERS • CARBIDE TOOLS

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass., Taps, Dies, Screw Plates.

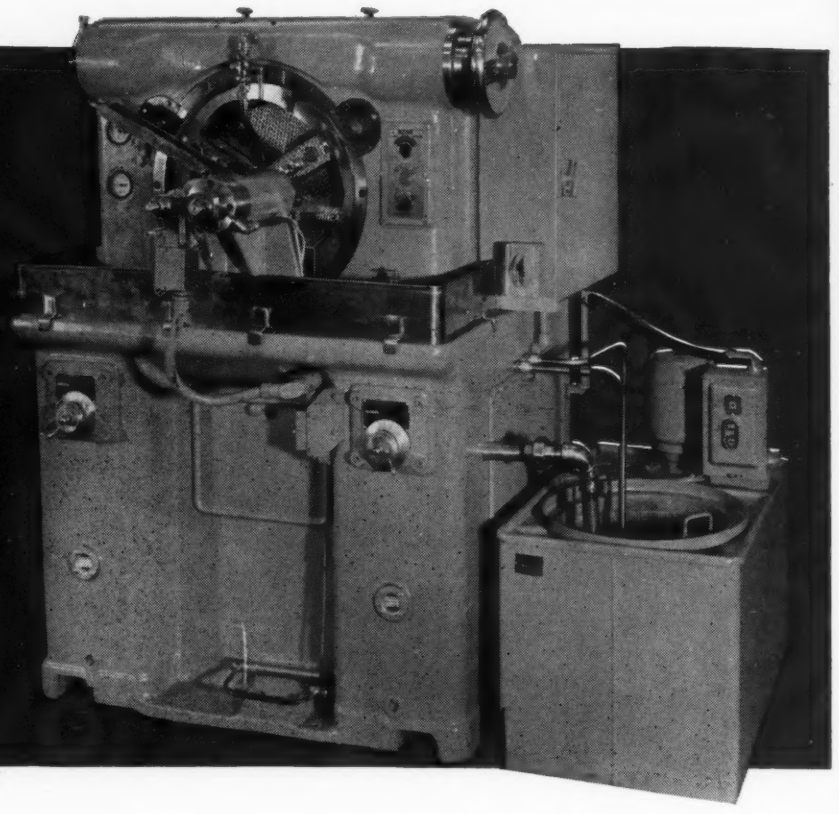
BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers.

BUTTERFIELD DIVISION, Rock Island. Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.

WANT CLOSE-FIT THREADS...*FAST?*

then you want

THE NAMCO TRIPLE ROLL HYDRAULIC THREAD and FORM ROLLING MACHINE with Magazine Feed and Hydraulic Loader



This new precision high-production machine is the perfect answer for shops that have a large volume of long and short thread work requiring up to class 4 fit and unsurpassed finish.

Operating on the feed-through principle, with interchangeable two-roll or three-roll heads, the Namco Thread-Roller regularly produces smoother, more accurate work than ground threads. Capacities range from $\frac{3}{8}''$ up to $1\frac{1}{2}''$ using three rolls—and $\frac{1}{8}''$ to $\frac{9}{16}''$ using two rolls. Because of three-roll operation and three-point support which eliminates distortion, the machine is a "natural" for hollow work.

With the addition of magazine feed and hydraulic loader, just announced, the Namco Thread Roller becomes the fastest, most versatile, *most accurate* means for threading and form rolling, solid or hollow work to close tolerances with fine finish. Send us samples of the jobs you do; we'll do the rest—in quoting you on your requirements.

Complete details on the Namco Thread Roller are contained in this new eight-page bulletin. Ask us for TR 47.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

For More Accurate Selection of Quality End Mills BROWN & SHARPE OFFERS 8 ADDITIONAL TYPES

Extra Long, Fast Spiral Single-End End Mill with Straight Shank.

Long, Fast Spiral Single-End End Mill with Straight Shank.

Long, Two-Flute Fast Spiral Single-End End Mill with Straight Shank.

Ball End, Two-Flute Fast Spiral Single-End End Mill with Straight Shank.

Long, Fast Spiral Double-End End Mill with 3/16" Straight Shank.

Long, Two-Flute Fast Spiral Double-End End Mill with 3/16" Straight Shank.

Fast Spiral Double-End End Mill with 3/16" Straight Shank.

Two-Flute Fast Spiral Double-End End Mill with 3/16" Straight Shank.

WRITE FOR THE NEW HANDY-SIZE CATALOG

describing important production-improving features of all Brown & Sharpe End Mills together with complete specifications and prices. There's a Brown & Sharpe quality end mill to meet every end milling need. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

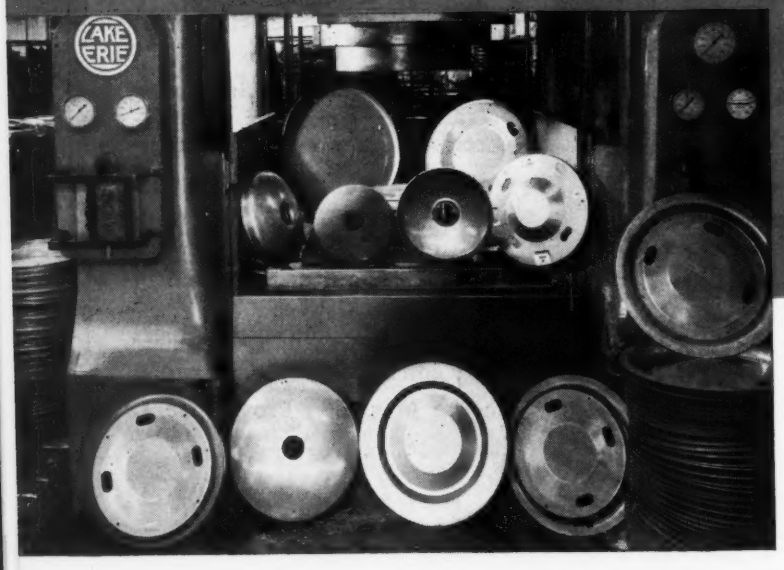
We urge buying through the Distributor

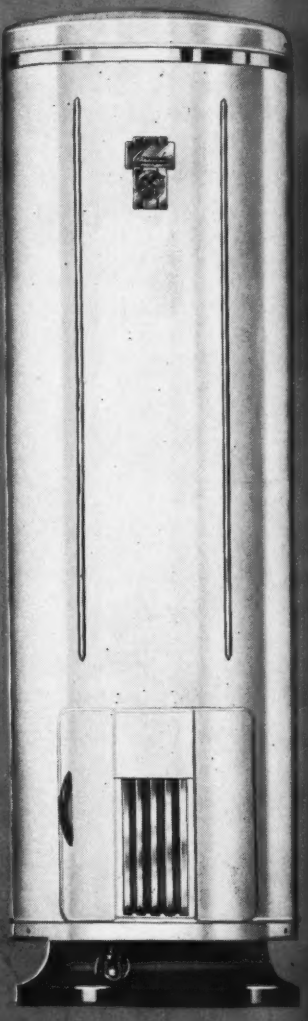
BROWN & SHARPE CUTTERS B·S

A. O. SMITH
gets top quality HIGH OUTPUT
with LAKE ERIE Hydraulic Press

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

THE A. O. SMITH Corporation of Milwaukee, Wisconsin report that the Lake Erie Hydraulic Press in their Kankakee plant meets every expectation. In their own words, "It is an excellent press for heavy materials and it is easy to set up and operate. Rate of production and quality of parts are gratifying." Today, leaders in metal forming such as A. O. Smith Corporation are taking advantage of the efficiencies possible with these newer hydraulic presses. They are enjoying increased production, improved product quality and lower unit costs. Why not consult Lake Erie about the possibilities for hydraulic press applications in your production. No obligation whatsoever.





PERMAGLAS automatic water heater manufactured by A. O. Smith Corporation has glass-lined tank, Fiberglas Insulation and many other new features. Tank ends and covers are efficiently produced on Lake Erie Hydraulic Press.

TWO MEN OPERATE the press. One man feeds parts in and the other removes them. Water heater tank heads are produced at the rate of 237 per hour, base plates at the rate of 259 per hour.

ILLUSTRATION SHOWS various water heater tank pieces produced and operations performed. The press is a versatile unit, easy to set up and operate, and forms heavy material (⅛" sheet steel) with ease and precision.

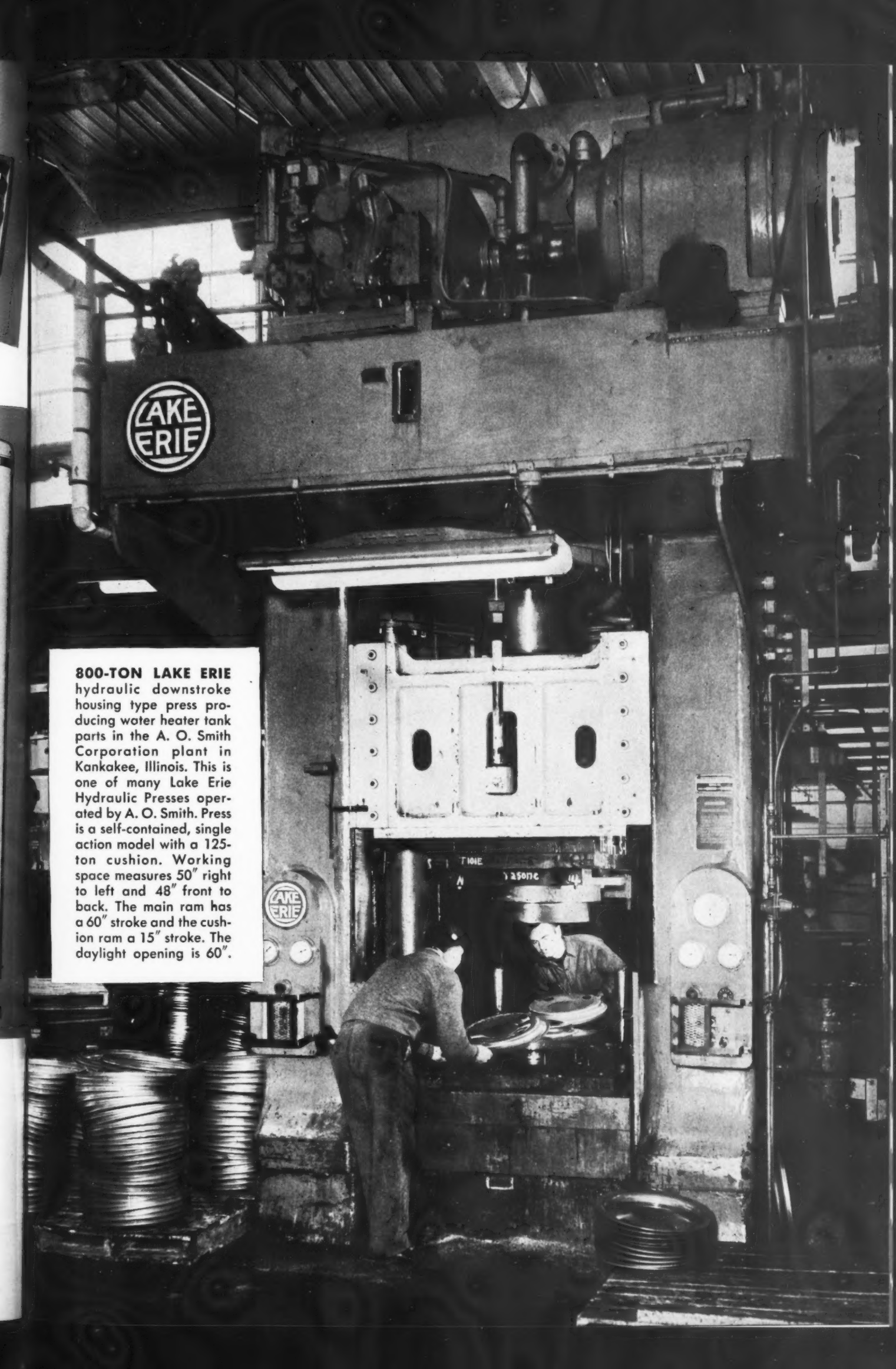
LAKE ERIE ENGINEERING CORP.

MANUFACTURERS OF
HYDRAULIC PRESSES AND SPECIAL MACHINERY

General Offices and Plant:
170 Woodward Avenue, Buffalo 17, New York

OFFICES IN PRINCIPAL CITIES AND FOREIGN COUNTRIES

LEADING MANUFACTURER OF HYDRAULIC PRESSES—ALL SIZES AND TYPES—METAL WORKING...PLASTICS MOLDING FORGING...METAL EXTRUSION....PROCESSING....RUBBER VULCANIZING...STEREOTYPING...SPECIAL PURPOSE



800-TON LAKE ERIE hydraulic downstroke housing type press producing water heater tank parts in the A. O. Smith Corporation plant in Kankakee, Illinois. This is one of many Lake Erie Hydraulic Presses operated by A. O. Smith. Press is a self-contained, single action model with a 125-ton cushion. Working space measures 50″ right to left and 48″ front to back. The main ram has a 60″ stroke and the cushion ram a 15″ stroke. The daylight opening is 60″.

TURN THEM OUT *FAST*, AT *LOW* COST

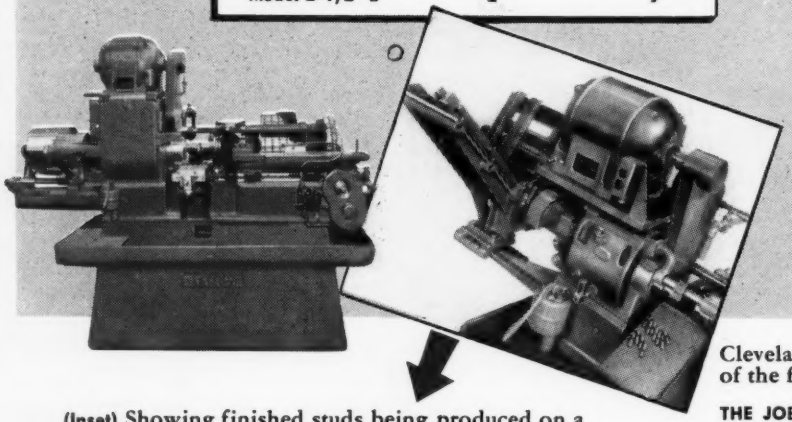
(A wide variety of materials, diameters, lengths, threads can be machined)

on these versatile CLEVELAND Automatics

CLEVELAND MODEL B
SINGLE SPINDLE AUTOMATICS

The ideal machine for solving stud problems. Handles a wide variety of diameters and lengths, and offers the user several different methods of production. First operation performed either on bar stock, or first and second operations performed on pieces cut to length and automatically loaded from vertical hopper magazines.

MAXIMUM MACHINE CAPACITY FOR STUD PRODUCTION		
Machine Size	**Diameter**	**Length**
Model 1-1/16" B	3/4"	8"
Model 2-1/2" B	2"	9"



(Inset) Showing finished studs being produced on a Cleveland 1-1/16" Model B recently delivered to a prominent manufacturer of automotive equipment. This machine is cammed to produce studs of the following sizes: 7/16", 3/8", 1/2", 9/16", 5/8" and 3/4".

THE JOB: 7/16" Stud from 3135 cold rolled steel. Blanks cut to length and pointed before being fed into machine.

1st OPERATION: Stud blanks fed through spindle from vertical hopper magazine and gauged from Rear Slide. Milling Slide cuts 7/16-14 thread, and pieces are ejected. 900 PIECES PER HOUR GROSS.

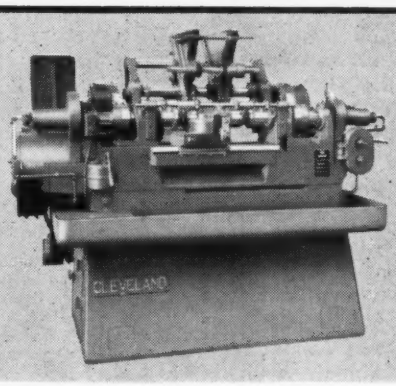
2nd OPERATION: (Same as 1st operation) Milling Slide cuts 7/16-20 thread, and pieces are ejected. 550 PIECES PER HOUR GROSS.

CLEVELAND MODEL J
DOUBLE-END AUTOMATICS

High speed magazine-loading machine capable of handling a wide range of special production involving work at both ends of the piece. Particularly suited for double-end threading of studs.

MAXIMUM MACHINE CAPACITY FOR STUD PRODUCTION		
Machine Size	**Diameter**	**Length**
Model J-1"	1"	11"
Model J-2"	1-1/2"	14"

Also longer lengths available on special order



Cleveland Model J-1" Automatic, cammed to produce studs of the following sizes: 7/16", 1/2", 9/16" and 5/8".

THE JOB: 7/16" Stud. Pieces cut to 4-1/8" length (as 1st operation on Cleveland 1-1/16" Model B) fed from hopper magazine to center gripping chuck. Two spindles carrying self-opening die heads cut 14 P thread 1" in length on both ends. 890 PIECES PER HOUR GROSS.

Whatever the job, if it calls for quality production at high speeds, there are Clevelands for automatic turning and forming of bar or tube stock sizes from 1/4" to 9-1/2", including multiple turning and forming of shafts and spindles up to 24" in length. Write for bulletins describing Clevelands suited to your production. Better still, get a Cleveland proposal on your next production job.

Remember, *Cleveland's Cut Costs*

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4936 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
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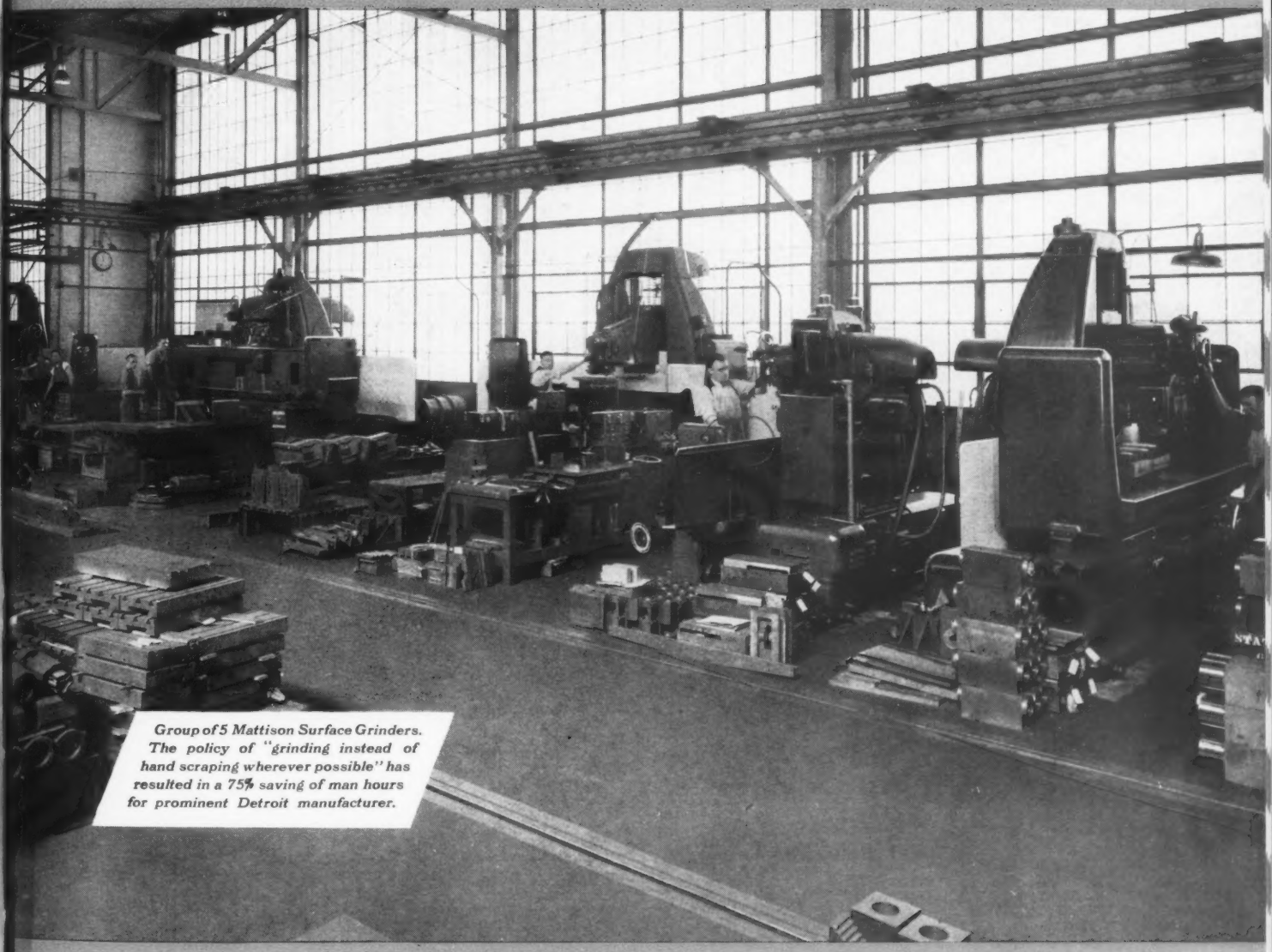
Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

ROCKFORD Metalworking Production Ideas

February, 1949



Group of 5 Mattison Surface Grinders. The policy of "grinding instead of hand scraping wherever possible" has resulted in a 75% saving of man hours for prominent Detroit manufacturer.

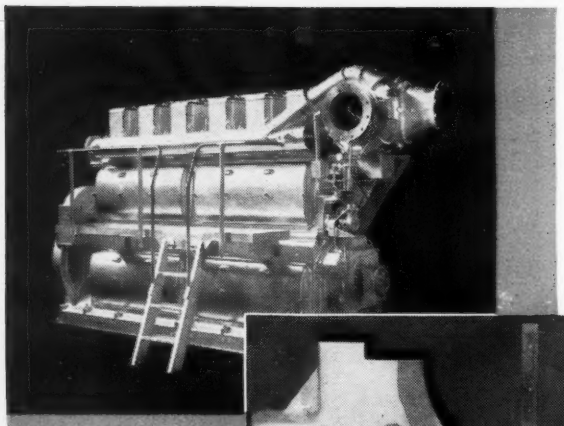
AMERICAN BROACH & MACHINE CO. Div. of Sundstrand Machine Tool Company ★ **ANDERSON BROS. MFG. CO.** ★ **BARBER-COLMAN COMPANY**

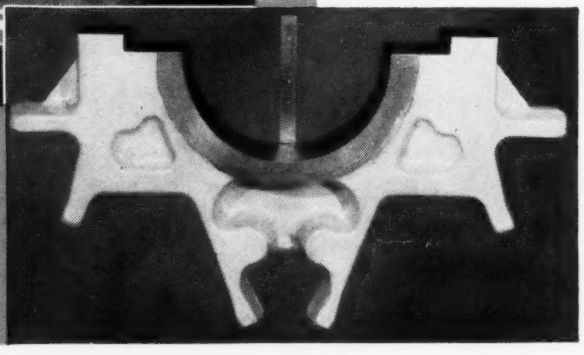
BARNES DRILL CO. ★ **JOHN S. BARNES CORP.** ★ **W. F. & JOHN BARNES CO.**

GREENLEE BROS. & CO. ★ **THE INGERSOLL MILLING MACHINE CO.** ★ **MATTISON MACHINE WORKS**

REHNBERG-JACOBSON MFG. CO. ★ **ROCKFORD MACHINE TOOL CO.** ★ **SUNDSTRAND MACHINE TOOL CO.**

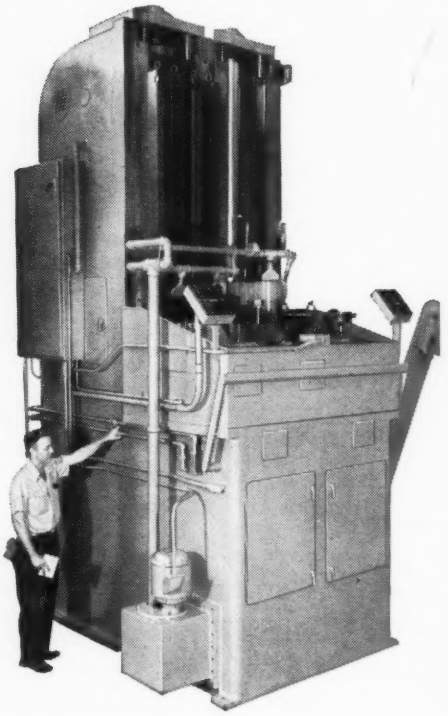
20 TIMES the PRODUCTION *by Broaching* DIESEL BEARING SUPPORTS





One half inch of stock is removed in broaching the stepped joint face and half round.

American provided the manufacturer of diesel engines with an SBD 72″-40 duplex surface broaching machine to finish broach the stepped joint faces and rough broach the 8″ diameter half round on main bearing saddle forgings.



Approximately sixty cubic inches of surface on this 150 pound diesel engine main bearing saddle forging is removed in broaching by the adaptation of an automatic indexing table and broach arbor arrangement.

The left hand station broaches the step joint faces in six passes and the right hand station rough broaches the half round surface in six passes. The left hand table automatically indexes at each pass and the arbor on the right hand ram also automatically indexes at each pass to develop the radius form with four sectional broach assemblies. One part is completed at end of the six continuous passes.

American engineers will recommend the machine and tooling whenever broaching is the answer to your machining problem. Send part print and production requirement or write for the name of our dealer in your territory They will be pleased to call.

AMERICAN *American* BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND MACHINE TOOL CO. S ROCKFORD ILLINOIS U.S.A.

See *American* First—for the Best in Broaching Tools, Broaching Machines, Special Machinery

MADE IN ROCKFORD... TESTED ENGINEERING AND CRAFTSMANSHIP ILLINOIS, U.S.A.

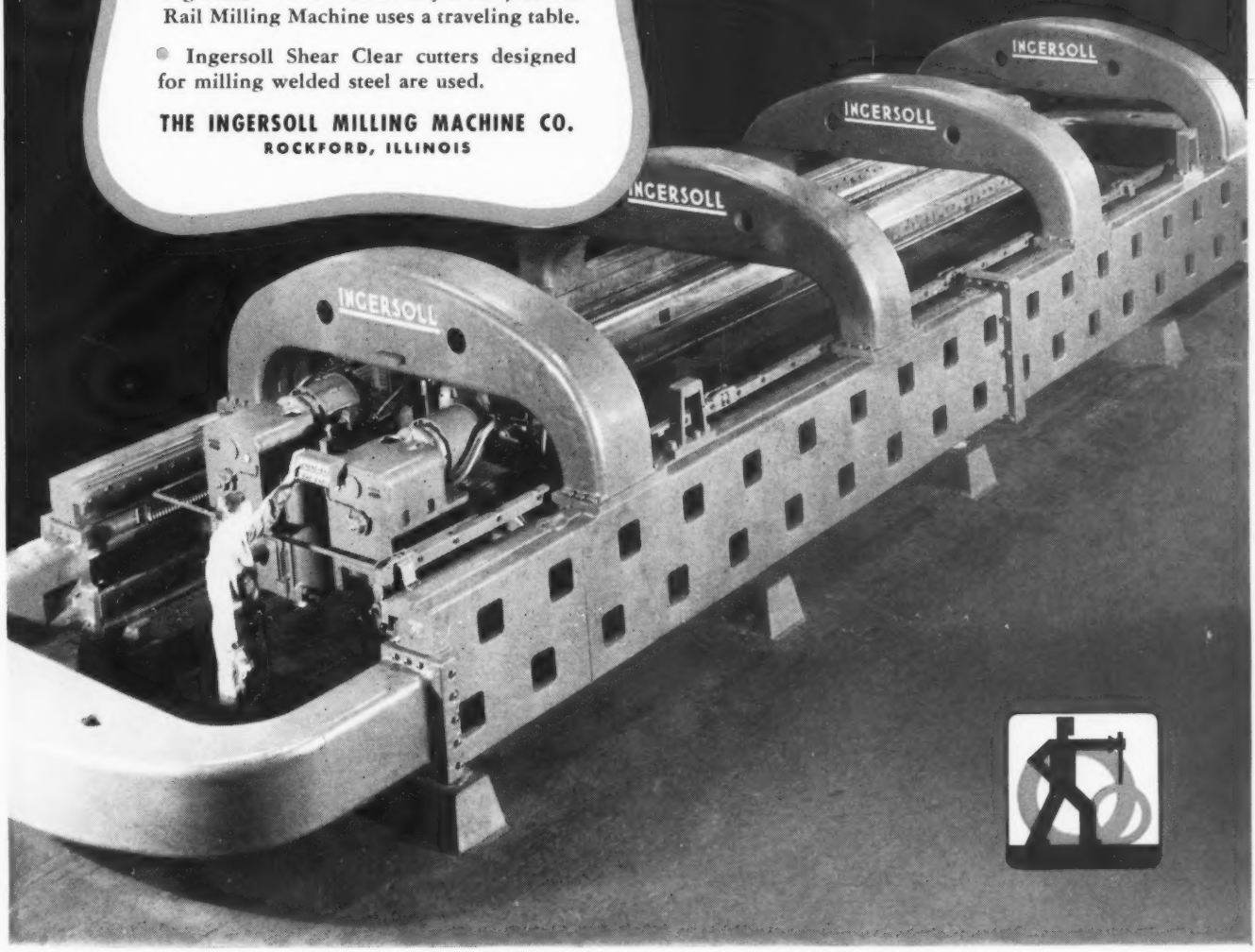
Ingersoll

A PORTABLE 55-TON INGERSOLL MILLING MACHINE, *with two Motor-Driven Heads,* is placed on welded steel locomotive frames by means of a crane. The milling heads are carried on a cross-rail which moves over the length of the machine to feed the heads over the parts of the frame which are to be machined.

In this way, the machine uses the traveling crossrail in the same way an Adjustable Rail Milling Machine uses a traveling table.

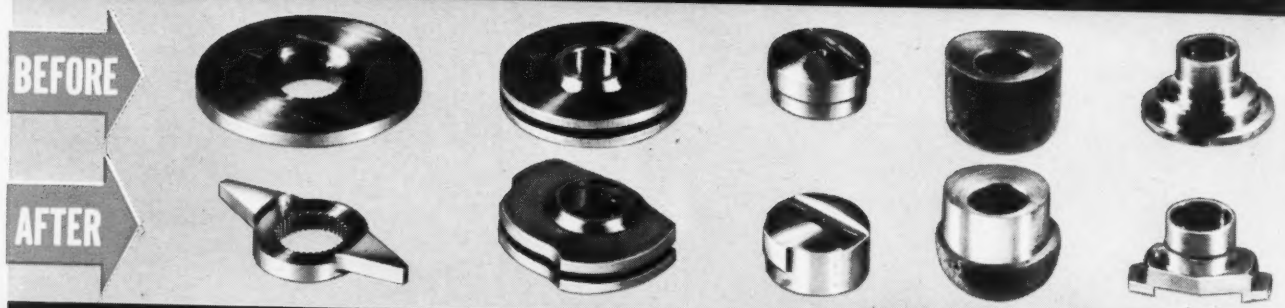
Ingersoll Shear Clear cutters designed for milling welded steel are used.

THE INGERSOLL MILLING MACHINE CO.
ROCKFORD, ILLINOIS



MADE IN
FOR RIGID ACCURACY IN MACHINE TOOLS...**ROCKFORD**
ILLINOIS, U.S.A.

If Your Production Requires Milling Intricate Parts Like These



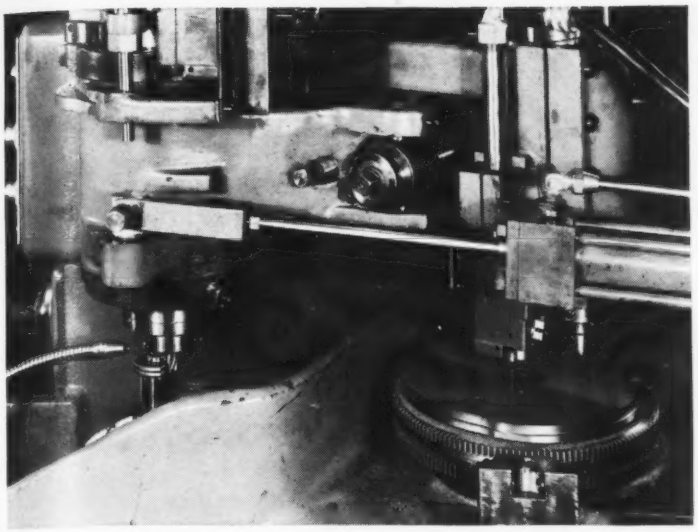
You Need the New Sundstrand *Cam-Controlled* Contour Milling Machine

SUNDSTRAND MACHINE TOOL CO. · ROCKFORD ILLINOIS U.S.A. ·

RIGIDMILS • FLUID-SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

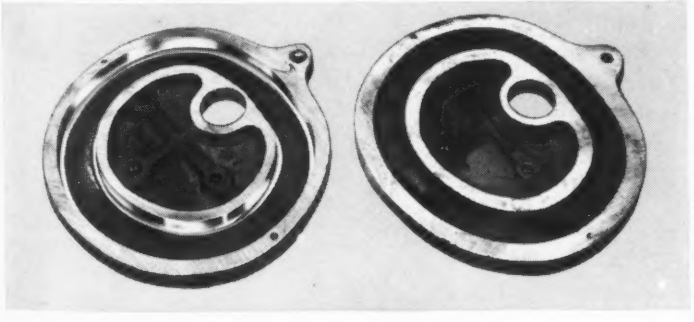
MADE IN ROCKFORD...FOR MACHINES DESIGNED TO SUIT YOUR PRODUCTION

ILLINOIS, U. S. A.



Mills Both External and Internal Cams

Yes, you'll find this new Sundstrand contour milling machine adaptable to an endless variety of milling operations on irregular shaped parts. It's a single vertical spindle cam-controlled, hydraulically operated milling machine. Both internal and external contours can be milled quickly and accurately on parts of 5″ diameter or less. Machine adjustments can be quickly and easily made for over 24 different cycle combinations. The ¾ HP adjustable speed spindle motor has ample power and speed range for the size of work for which the machine is intended. Since one operator can easily attend several machines, cams of various shapes can be produced at a savings on a production basis. Illustrated below is a good example of internal contour milling. Typical examples of other external contour milling operations are illustrated on the opposite page. Sewing machine, gun, governor, business machine and many other small parts can be handled on this versatile machine.



Mills Master Cams

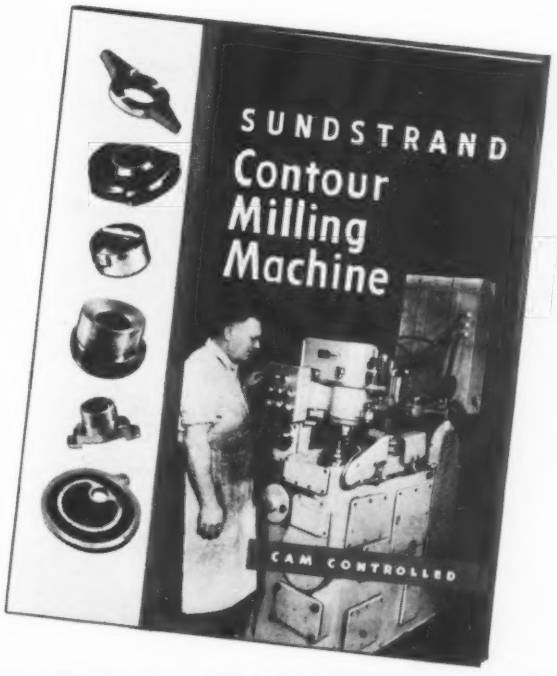
You will save many hours of engineering intricate cam profiles with this machine. Through the substitution of a cam-cutting spindle to replace the cam roller spindle, the machine operating procedure can be reversed to produce cams by merely following the sample part which is clamped in the fixture on the machine table.

Simple to Operate

In spite of the complex work performed by this machine, it is amazingly simple to operate. It is completely automatic, yet easy to set-up for the different jobs. This simplicity of operation makes it possible for one man to handle several machines without sacrifice of accuracy or production.

Write for Complete Data

This new 6-page folder contains complete information and specifications of this production contour milling machine. More detailed description covering the 24 automatic cycles and how easily they can be set-up to handle the milling of a wide variety of contours is included. If your work includes milling intricate contours on a production basis, get this bulletin on the new Sundstrand cam-controlled milling machine. It's FREE. Ask for Bulletin No. 680.



SUNDSTRAND
MACHINE TOOL COMPANY
2530 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

MADE IN
CENTER OF MACHINE TOOL EXCELLENCE...ROCKFORD
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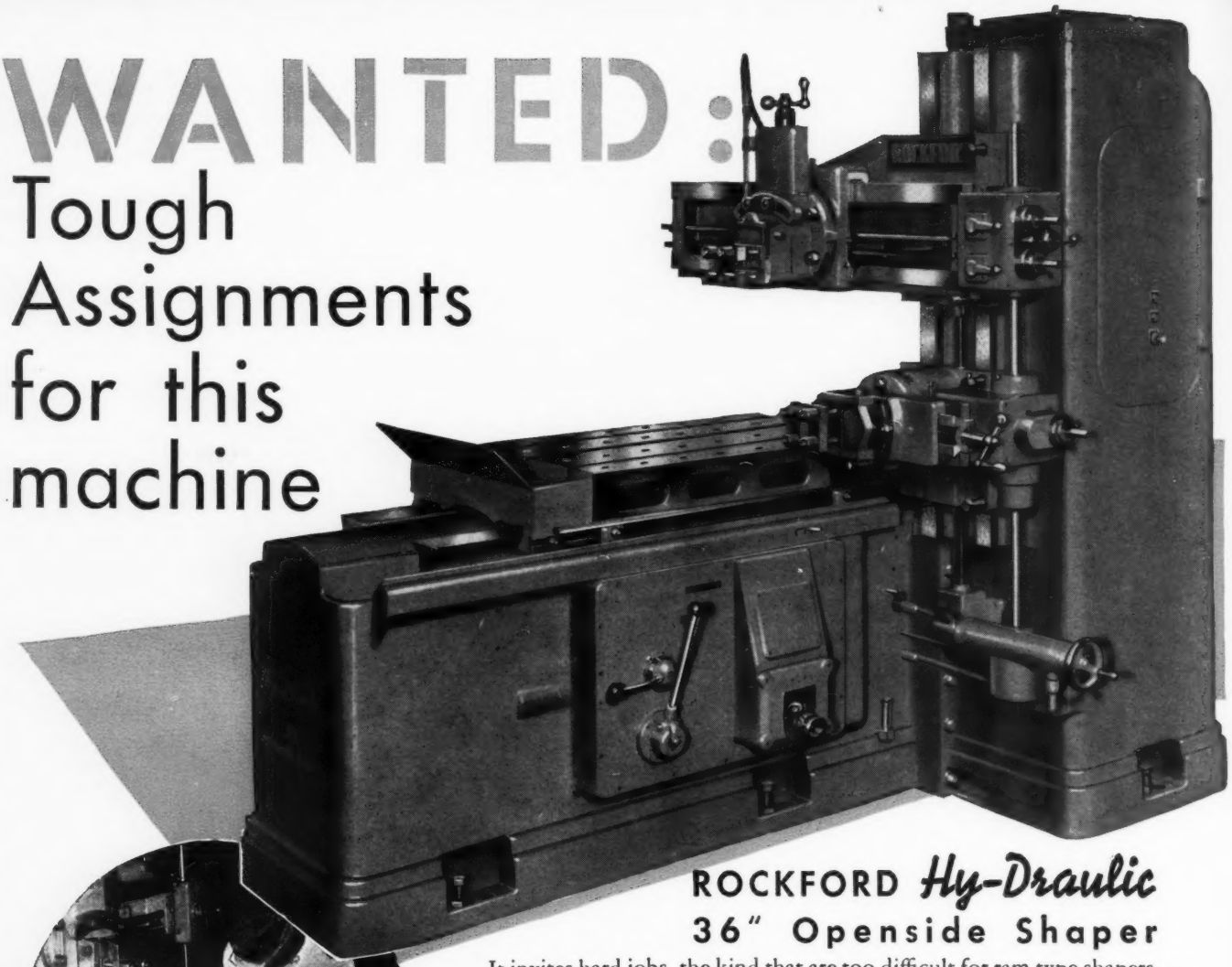
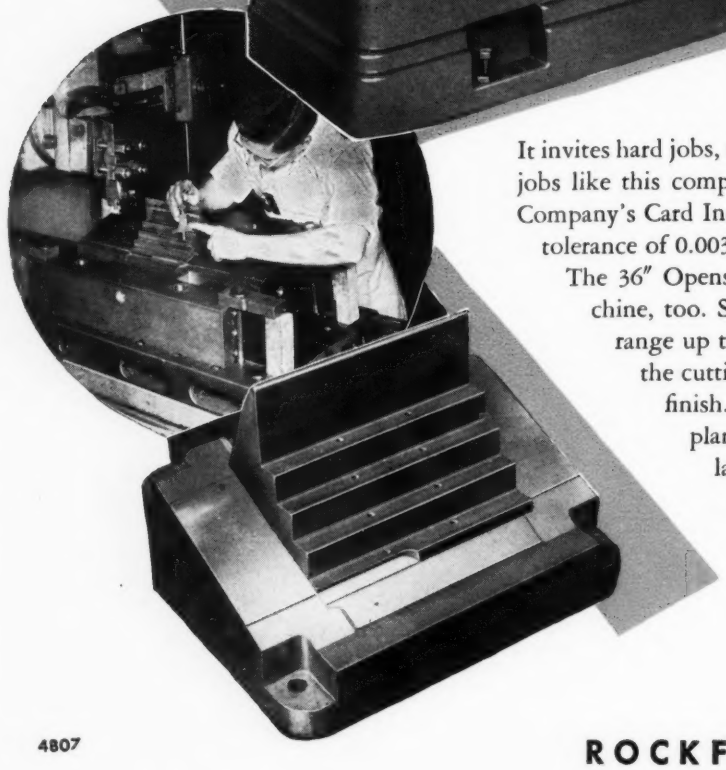
WANTED:
Tough Assignments for this machine





ROCKFORD *Hy-Draulic* 36" Openside Shaper

It invites hard jobs, the kind that are too difficult for ram type shapers . . . jobs like this compound angular die for Burrough's Adding Machine Company's Card Index Case . . . cut out of tough die casting steel to a tolerance of 0.003".

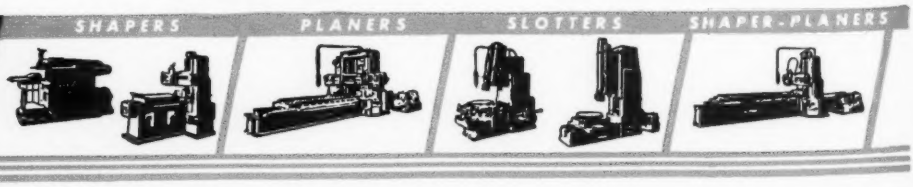
The 36" Openside Shaper is an exceptionally fast production machine, too. Set-ups are quickly and easily made. Cutting speeds range up to 110 ft. per min. and are infinitely adjustable, with the cutting stroke maintained at uniform speed from start to finish. Reversal is quick and return rapid. Full-length, planer type table support permits machining of very large or heavy work . . . and assures exceptionally high precision cutting, often eliminating the need for further finishing operations.

It will be well worth your while to find out how a Rockford *Hy-Draulic* Shaper, Planer, Shaper-Planer or Slotter might speed up or improve operations in your shop. Send your blueprints to our engineering department and we will furnish machine time estimates for comparison.

4807

ROCKFORD MACHINE TOOL CO.
ROCKFORD ILLINOIS

Hy-Draulic
REG. U.S. PAT. OFF.



MADE IN ROCKFORD... FOR ACCURATE, FAST METAL REMOVAL
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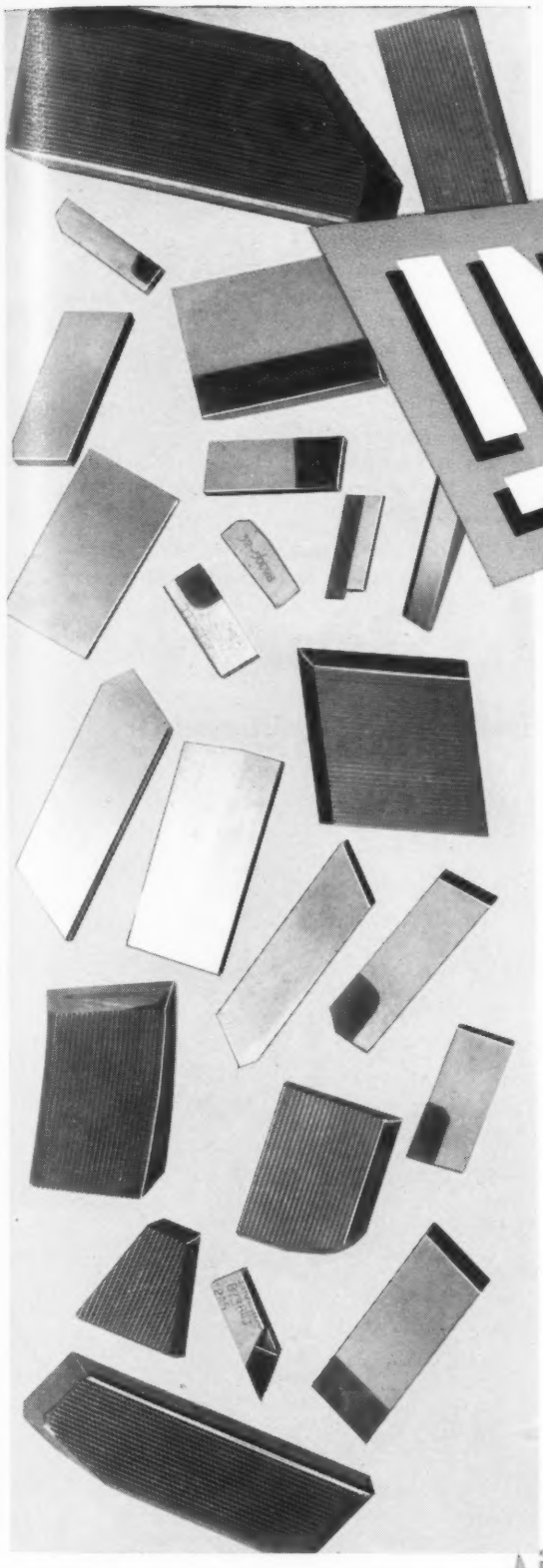

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ALL TYPES... Carbide Tipped, Cast Alloy, High Speed Steel, ...Plain, Serrated, Helical

AT SAVINGS... Highest Quality, Prompt Delivery, Many Types in Stock

Ingersoll specializes in the manufacture of high quality precision blades of all types and materials. Modern high production machinery makes this possible at competitive prices. Send us prints or samples of your requirements for quotation. Savings are effected by buying in large quantities.

INGERSOLL INSERTED BLADE MILLING AND BORING TOOLS

This book is intended to help you properly select cutters for your work. It includes illustrations, detail drawings, specification tables, grinding charts, how to order and other useful data.

INGERSOLL CUTTER GRINDER

This book shows through illustrations and diagrams the wide range of application of the Ingersoll cutter grinder and contains helpful information for the operator.

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THE INGERSOLL MILLING MACHINE CO.
ROCKFORD, ILLINOIS

Please Send Catalog Checked

Cutter Catalog 56B ☐ Cutter Grinder Catalog 57B ☐

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YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN... ROCKFORD ILLINOIS, U.S.A.

exceptional tool life....

roughing and finishing

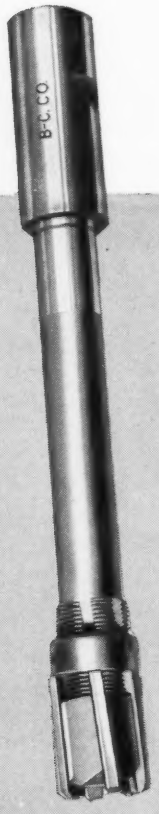
with

BARBER-COLMAN CARBIDE TIPPED REAMERS

Vibration and end-play may vary from spindle to spindle on multiple reaming operations. Therefore, reamer design is even more important in controlling identical holes at each station. Barber-Colman Inserted Blade Reamers with carbide tips, used on this operation, are built with floating holders and magic-chuck drives. This permits reamers to seat themselves independently of machine conditions and produces accurate, straight, round holes.

Barber-Colman Reamers are made with irregularly-spaced blades to give smooth cutting action and finely finished work. This feature eliminates welts frequently caused by uniform spacing. Long tool life is assured with the rigid mounting provided by wedges and an adjusting collar which prevent any blade movement during reaming.

Consult Barber-Colman Reamer Engineers on your reaming problems. Quotations will be furnished on receipt of blue-prints and production requirements.



Barber-Colman Company

GENERAL OFFICES AND PLANT 526 LOOMIS ST., ROCKFORD, ILLINOIS, U.S.A.

JOB RECORD

Operation — Ream valve tappet holes

Material — Gray cast iron

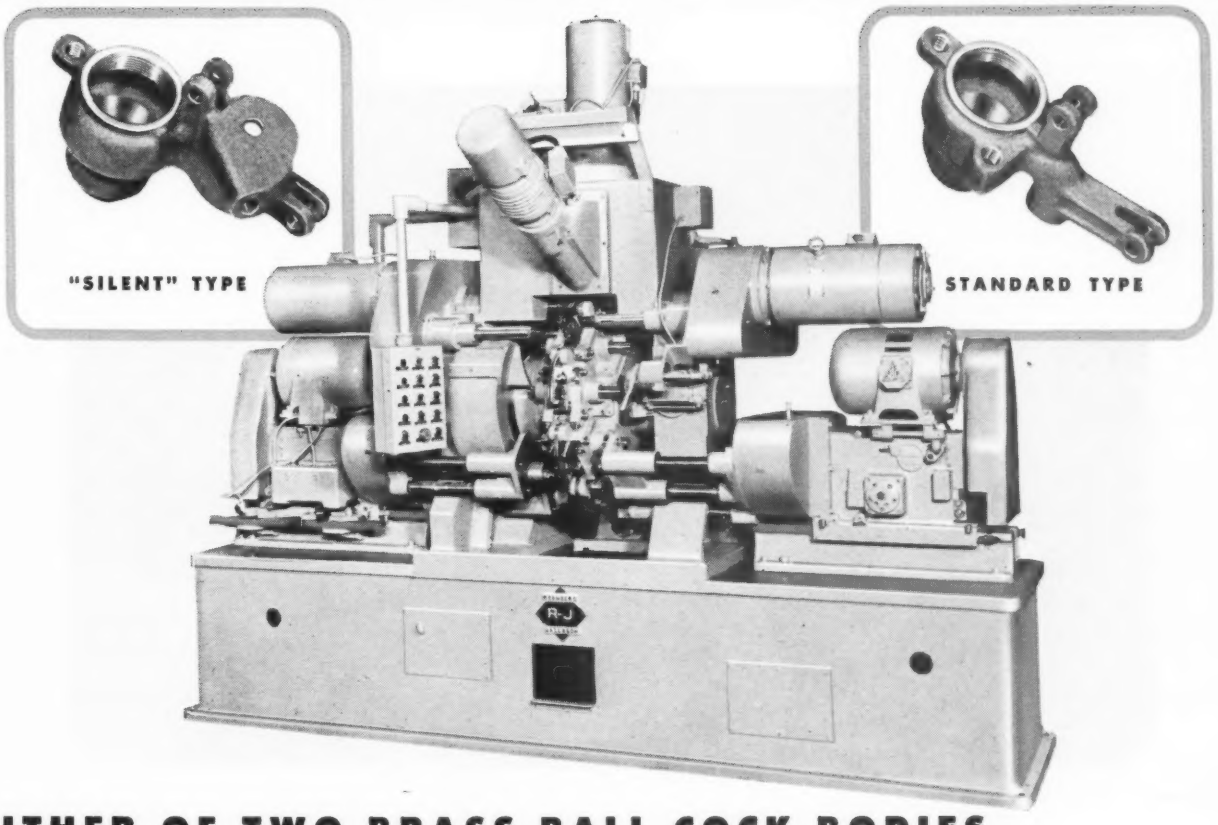
	Roughing	Finishing
Feed —	8.32" per min.	16.6" per min.
Speed —	81 SFM	36 SFM
Tool Life —	4000-5000 holes per sharpening	16000 - 18000 holes per sharpening
Tolerance —	Size .990"/.991"	

BARBER COLMAN

MODERN MACHINES DEMAND *Modern* CUTTING TOOLS

MADE IN ROCKFORD...MACHINE TOOL SHOPPING CENTER ILLINOIS, U.S.A.

Rehnberg-Jacobson



EITHER OF TWO BRASS BALL COCK BODIES CAN BE COMPLETELY FINISHED ON THIS ONE MACHINE

Here is a lot of ingenuity in a single, fairly simple package. With only a few quickly-accomplished changes, this machine can be switched over to machine *completely* in a single chucking *either* of the two types of brass ball cock bodies illustrated above. The "silent" type of body is more complicated, as it includes an angular 2-step hole that is partly tapped, as well as 5 drilling, 3 boring, 3 facing, 2 chamfering, 1 counterboring, 1 seat finishing, and 7 tapping operations. The standard type of body requires 5 drilling, 2 boring, 2 facing, 3 chamfering, 1 seat finishing, and 7 tapping operations, several of which are in different positions than on the other body. Repositionings of two sets of spindles are accomplished by 4-spindle heads which can be indexed 180° to bring either of two pairs of spindles into action. On other heads, multiple spindles are provided and tooled selectively as required. Several spindles employ combination tools. The machine is rated for a 12-second cycle, giving a production capacity of 300 pieces per hour.

ANOTHER R-J MACHINE FOR BRASS GOODS MANUFACTURERS

This is the most recent of several types of machines designed and built by Rehnberg-Jacobson for manufacturers of brass plumbing goods. The trend in this industry has been toward the use of specialized multi-purpose machines to replace more costly manufacturing methods on standard machines. R-J machines, with their relatively simple structures, standard drilling, tapping, and indexing units, and ingenious tooling and work-holding methods, have proved particularly advantageous for this kind of work.

REHNBERG-JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF SPECIAL MACHINERY

2135 KISHWAUKEE ST. ROCKFORD, ILLINOIS

MADE IN ROCKFORD MADE MEANS PRECISION MADE... ROCKFORD ILLINOIS, U.S.A.

GREENLEE

AUTOMATIC TRANSFER MACHINE

VIEW FROM LOADING END

PERFORMS 120 OPERATIONS

STATION 1		
Load and Turn Over 180 Degrees		
LEFT HAND UNITS		RIGHT HAND UNITS
STATION 2		
Drill 12 Holes		Drill 14 Holes
Drill & Chamfer 2 Holes		
STATION 3		
Drill 7 Holes		Drill 10 Holes
STATION 4		
Drill 3 Holes		Drill 2 Holes
C'Bore & Chamfer 1 Hole		11" Deep
Ream 2 Holes		
STATION 5		
Drill 4 Holes		Drill 1 Hole
Ream 2 Holes		Ream 2 Holes
Chamfer 11 Holes		Chamfer 16 Holes
STATION 6		
Tap 14 Holes		Tap 17 Holes
STATION 7		
Unload		
58 OPERATIONS		62 OPERATIONS

TOTAL — 120 OPERATIONS

FOR PROCESSING CYLINDER BLOCKS

PRODUCES 45 BLOCKS PER HOUR... AT 80% EFFICIENCY

This 7-station automatic transfer machine performs a total of 120 individual drilling, chamfering, counterboring, reaming, and tapping operations in a continuous cycle on cylinder blocks for a leading automobile manufacturer. The loading end of the machine is equipped with a turnover fixture that revolves the work 180 degrees, eliminating handling of the piece as it is received from previous machining operations.

Greenlee patented precision-ground individual lead screw spindles tap a total of 31 holes in both ends of the cylinder blocks. All tapping units are provided with a rapid approach and return stroke. Automatic tap lubrication insures clean, precision-cut threads with maximum tool life.

The electrically-controlled hydraulic units are easily accessible for set-ups and for making tool changes, and are designed so they can be independently operated. Ample room is provided between stations for work inspection. Automatic lubrication of each vital moving part assures long machine life and efficient operation.

The experience of Greenlee engineers and the skill of Greenlee manufacturing personnel were combined to produce this machine. The effectiveness of this Greenlee team can be used by you, too, toward the licking of *your* production machinery problems.

PRODUCTION MACHINERY

GREENLEE

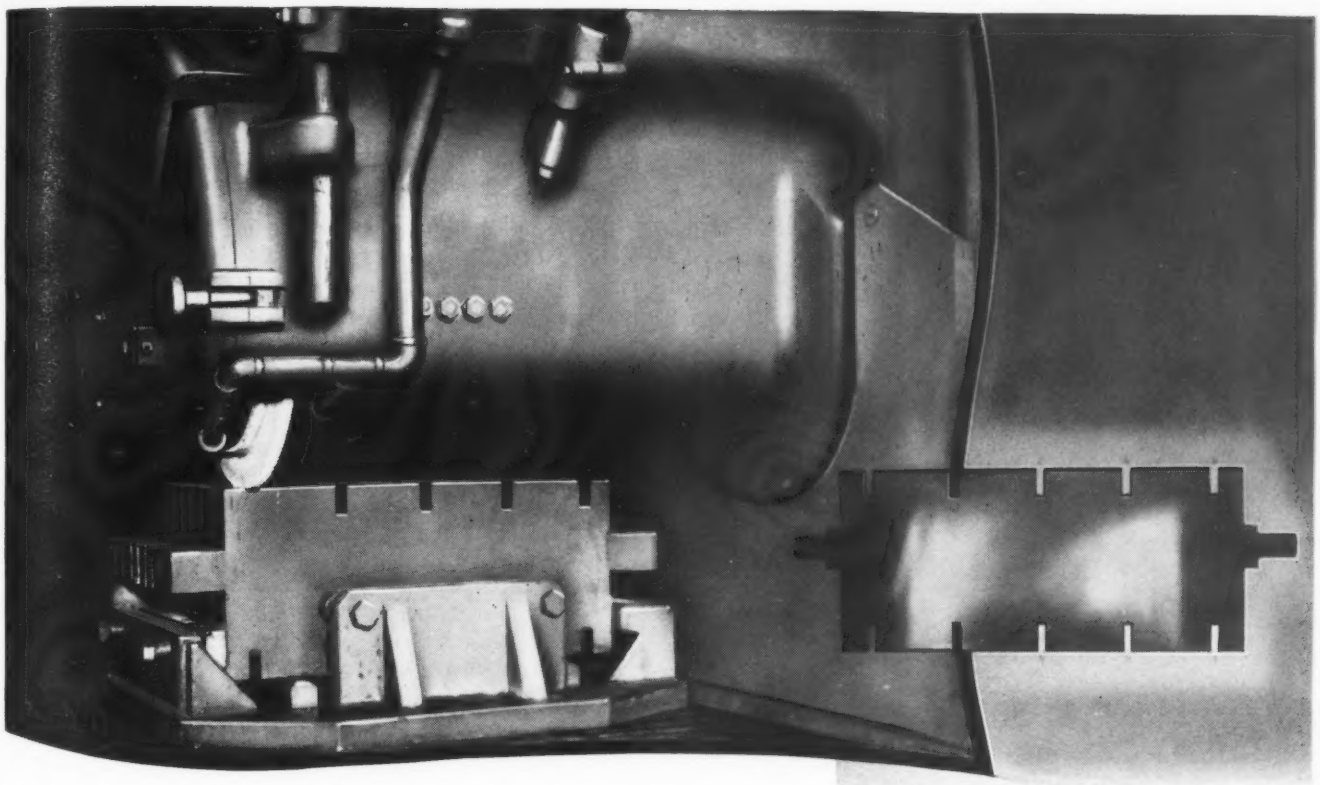
Additional Information Available Upon Request

GREENLEE BROS. & CO., 1862 Mason Ave., Rockford, Ill.

DETROIT OFFICE: 504 CURTIS BUILDING, DETROIT 2, MICHIGAN

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

MADE IN ROCKFORD...CITY OF MACHINE TOOL SPECIALISTS ILLINOIS, U.S.A.



PLUNGE CUT GRINDING *Saves 90 minutes per plate*
ELIMINATES MILLING OF SLOTS, REWORK AND SCRAP

● MACHINE: Mattison High-Powered Precision Surface Grinder with Automatic Down Feed.

MATERIAL: 1¼″ x 8¼″ SAE 1020 Steel ground to thickness, milled and ground to length, Heat Treated and Oil Quenched to Rockwell 50-55C.

PREVIOUS METHOD: Plates were rough milled to .468″ slot width and slot ground after heat treating. This method produced an excess of scrap because of slot distortion due to heat treatment.

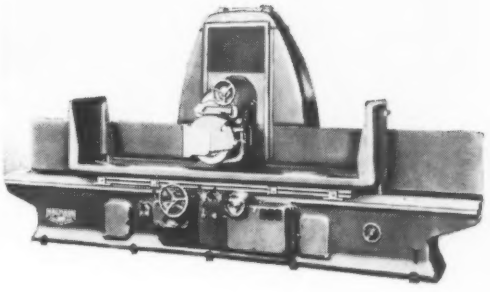
PRESENT METHOD: Twenty plates are assembled together and clamped to magnetic chuck. The slots .500″ wide by 1.250 deep are plunge ground to size, one slot at a time, with length gauge to determine spacing. Depth of cut is controlled automatically.

SAVINGS: The new plunge cut grinding method eliminates the milling of slots, rework and scrap. On the 1¼″ thick plates there is a saving of 90 minutes per plate, 105 minutes on the ¾″ and 110 minutes on the ½″.

WHEEL USED: Norton 20″ x .515″ x 8″ dia. hole No. 57A4605V dressed to .499″ plus .001″.

The high power, speed and ruggedness of construction and large capacity of Mattison Grinders are factors that make results like this possible. To determine what can be done with your work send us blue prints for production estimates.

The above data on savings of time and material was effected by a Mattison Surface Grinder at the plant of Besser Manufacturing Co., of Alpena, Mich. The information was submitted by Mr. R. M. Douglas, Vice-Presidnet and Production Manager.



Write for Free Set-Up Book showing how others have reduced time and cut costs with Mattison Grinders.

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

MADE IN

FOR PRODUCTION MACHINE TOOLS IT'S...ROCKFORD

ILLINOIS, U.S.A.

production sharpening • precision sharpening

IT'S ALL THE SAME ON THE 6-5

The ease with which precision sharpening is accomplished on the No. 6-5 Hydraulic Hob Sharpening Machine, is demonstrated in this actual job record.

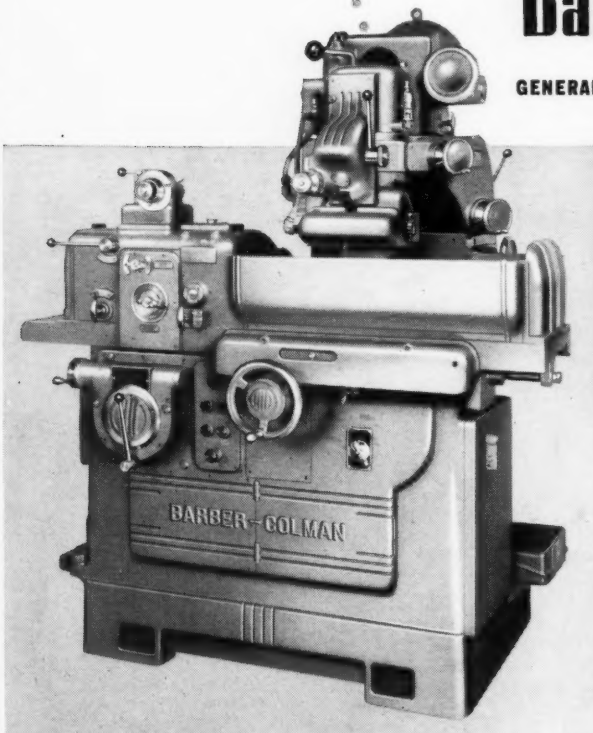
This application shows the accuracy obtained when sharpening large diameter, taper root spline hobs. These hobs are 5″ in diameter, with decreased cutting depth from the large to the small end for hobbing a tapered root diameter on spline shafts, and are made with 26 teeth to produce excellent finish with a fine feed mark pattern.

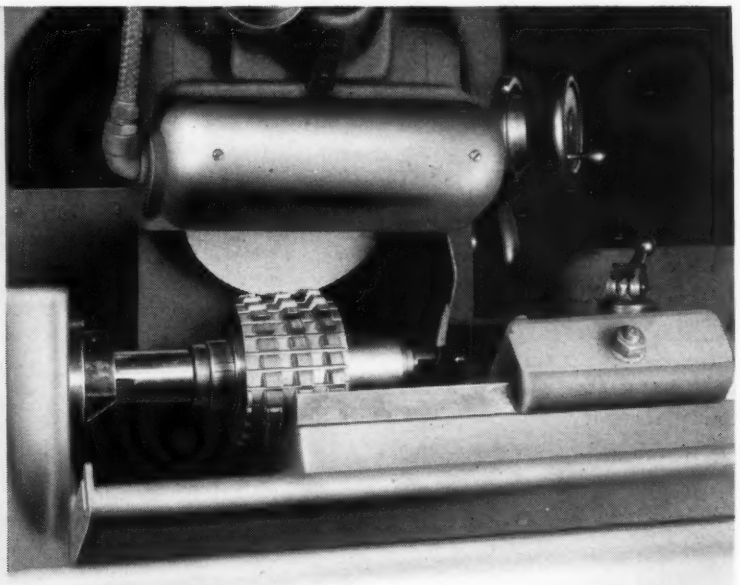
When sharpening with ordinary methods, deflection of the wheel sometimes occurs as the wheel pressure against the teeth diminishes toward the shallow depth. This condition is eliminated on the No. 6-5 because of the rigidity built into the wheel head, and the precision control provided over indexing and table travel. Sharpening tolerances maintained on a complete lot of 20 hobs are shown.

Write for complete information on the 6-5 Machine. Ask for Bulletin 3212.

Barber-Colman Company

GENERAL OFFICES AND PLANT 126 LOOMIS ST., ROCKFORD, ILLINOIS, U.S.A.





JOB FACTS

Operation — Face sharpen Taper Root High Speed Steel Spline Hobs to class AA tolerances

Hobs—5″ diameter x 3-1/2″ face

Gashes—Straight	Cutting Faces—Radial
Depth of Grind—25/64″	Wheel—7″ Carborundum
Stock Removed—.010″	Feed per Rev.—.0005″
Wheel RPM—3600	Coolant—Micro-Grind

Accuracy—Adjacent spacing—.0005″
Non-adjacent spacing—.001″
Radial faces—.0003″

BARBER COLMAN — EASIER, MORE ACCURATE HOB SHARPENING...

MADE IN **ROCKFORD**...MACHINE TOOL PLANTS CLOSE TO YOUR PLANT
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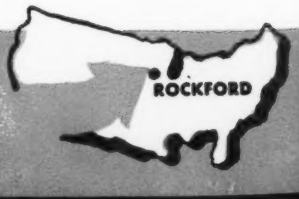

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Complete Pieces

IN ONE HOUR

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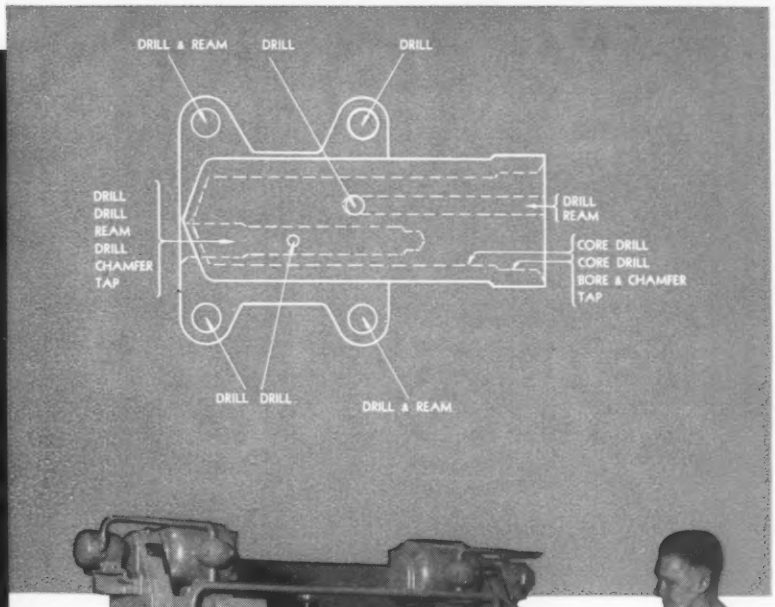
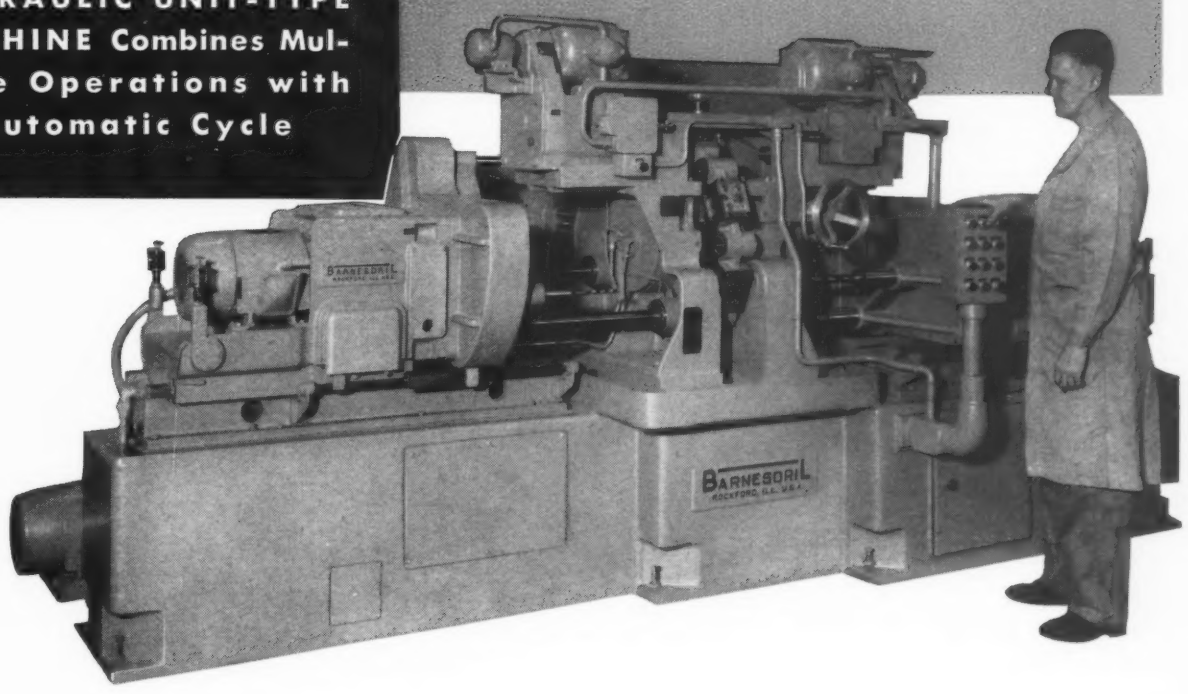
HYDRAULIC UNIT-TYPE MACHINE Combines Multiple Operations with Automatic Cycle





"TAILORED-SKIL by BARNESDRIL"

These cast iron hydraulic accumulator housings have a total of eighteen operations for drilling, reaming, chamfering and tapping. 100 complete housings per hour are produced on this special BARNESDRIL Production Unit-Type Machine. Arranged with automatic cycle and drum type automatic indexing table, the machine has 4 self-contained horizontal opposed units and 2 vertical lead screw tapping units. All eighteen operations are combined in one automatic cycle of the machine, requiring the operator to load and unload only. Non-productive machine time and work handling have thus been reduced to a minimum.

BARNESDRIL Production Unit Machines can be arranged for a large number of drilling, reaming, tapping, threading, facing, counterboring or milling, either in combined multiple operations or progressively. Consult your BARNESDRIL Representative for details on application to your machining problems. Send for Bulletins B1505 and B35.

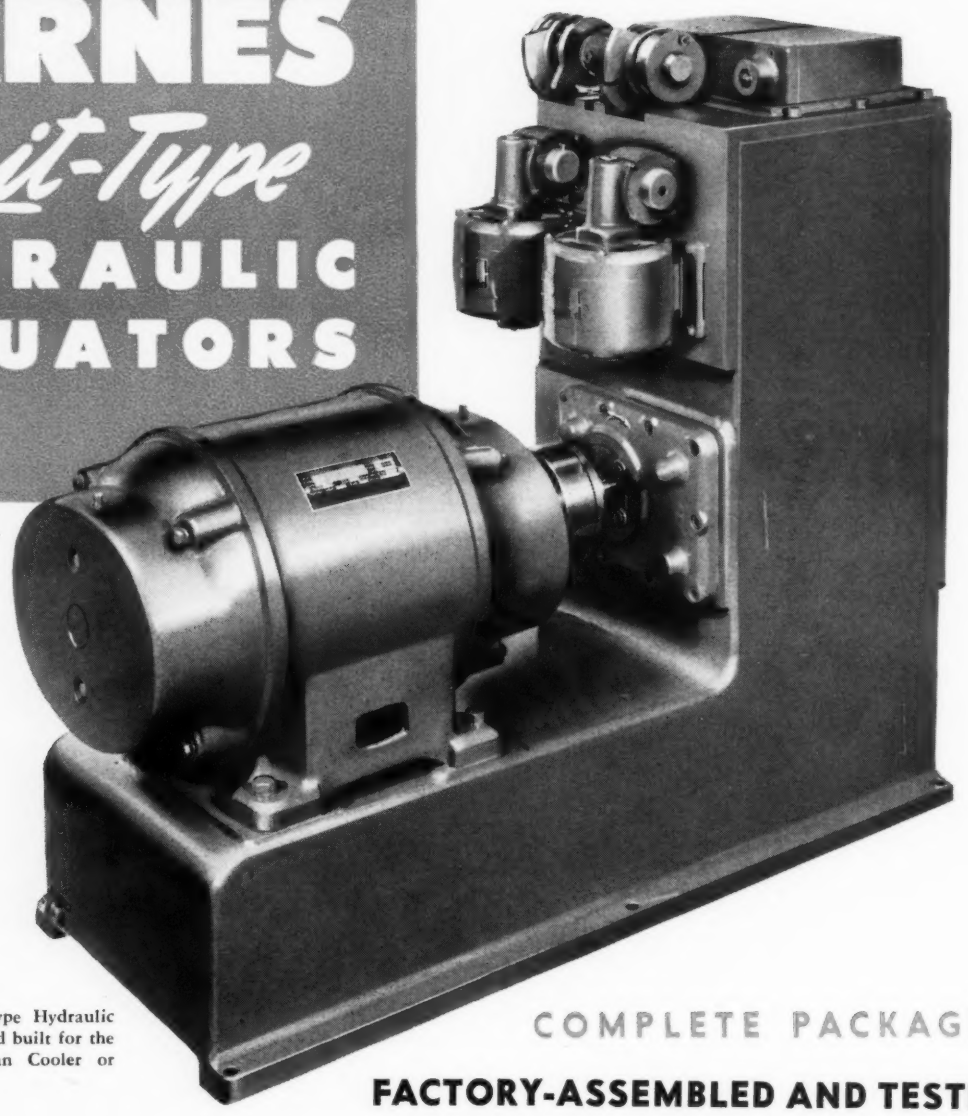
BARNES DRILL CO.

820 CHESTNUT STREET ROCKFORD, ILLINOIS U.S.A.

MADE IN

FOR METAL REMOVAL WITH ACCURACY AND SPEED...ROCKFORD ILLINOIS, U.S.A.

BARNES *Unit-Type* HYDRAULIC ACTUATORS



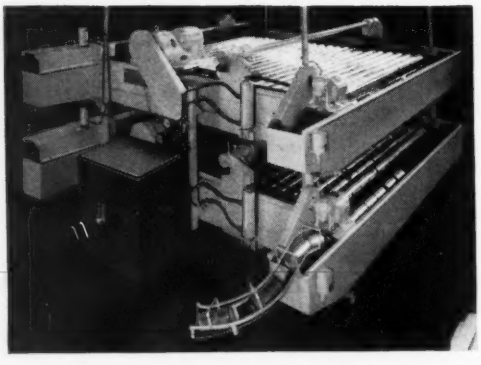
This BARNES Unit-Type Hydraulic Actuator is designed and built for the REX Thermo-Roto Can Cooler or Heater shown below.

COMPLETE PACKAGES...

FACTORY-ASSEMBLED AND TESTED...

DESIGNED TO MEET YOUR ACTUATING REQUIREMENTS...

REQUIRE MINIMUM TIME FOR MOUNTING AND CONNECTING...



Chain Belt Company of Milwaukee builds this REX Thermo-Roto for rapid and uniform cooling or heat processing of canned foods.

Let us help solve your hydraulic actuation problems. BARNES Units contain all the important elements in a compact package — motor, pump, reservoir, relief valve, pressure controls, distribution manifold, all associated piping and wiring, and any special features needed. BARNES Units are available in standard types, or with suitable modifications, or as a complete special design, to meet a wide range of speed and pressure requirements. Elements comprising BARNES systems are distinctive BARNES developments, and are patented. Why not take advantage of our ability—and thus save yourself a lot of time and trouble?

John S. Barnes Corporation
301 S. Water St., Rockford, Illinois

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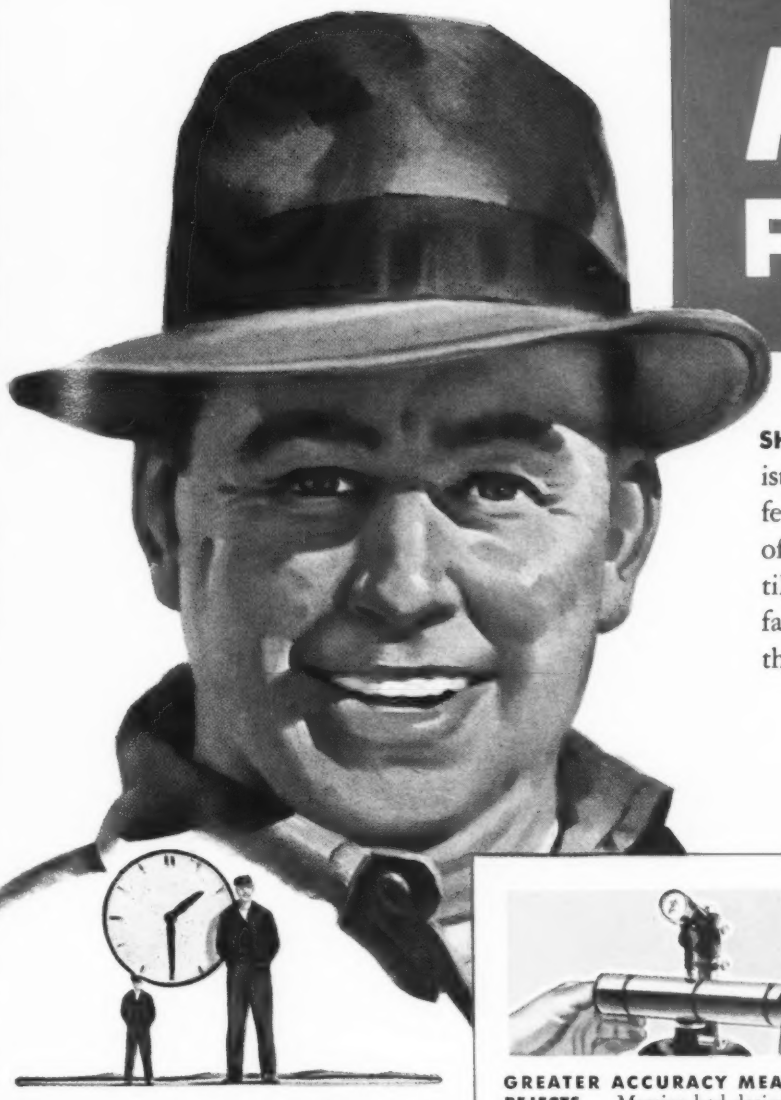
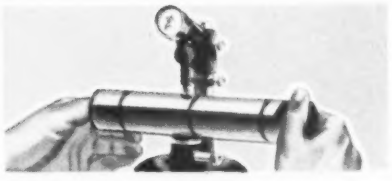
ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS
ILLINOIS, U.S.A.

AXELSON FIRST CHOICE

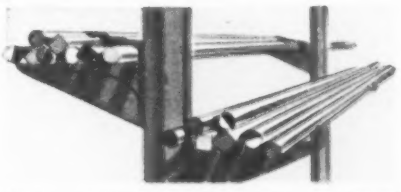


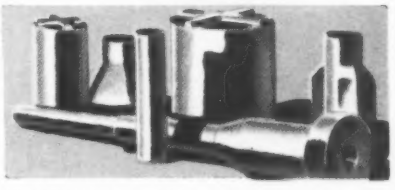
SHOP SUPERINTENDENTS AGREE that machinists produce more work of higher quality with fewer rejects on AXELSON engine lathes, because of their infinite ease of operation, greater versatility, and in-built precision. Control of manufacture... from foundry to assembly... makes this possible.

MORE PRODUCTION PER MAN-HOUR results when a job goes on an AXELSON lathe... machinists actually like to operate them... location of controls minimizes lost motion... extreme rigidity permits faster speeds... ample smooth power for the deepest cut without slowdown.



GREATER ACCURACY MEANS FEWER REJECTS... Massive bed designed to maintain absolute alignment... spring tension scrapers and felt wipers on carriage prevent dirt and chips from galling the ways... operator has complete, precision control of the cutting at all times.





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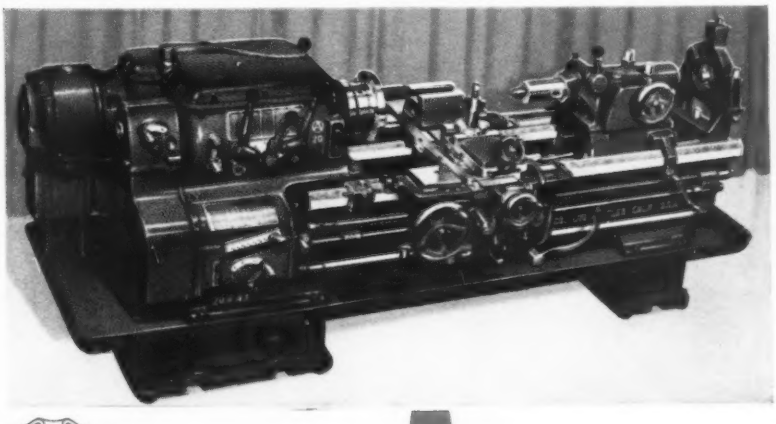

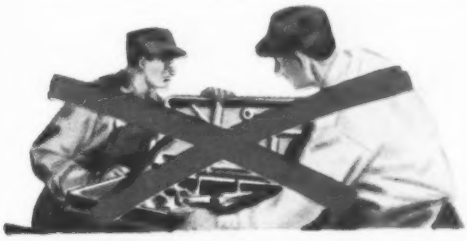

MINIMUM MAINTENANCE AND REPAIR.. Easier to tool-up and retain precision settings... forced-feed lubrication to carriage and cross slide ways, eliminates wear – gibbed slides permit easy compensating adjustments... all parts designed for longest life with the least maintenance.

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

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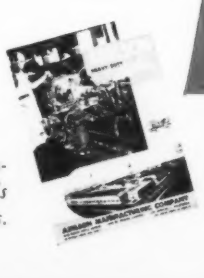

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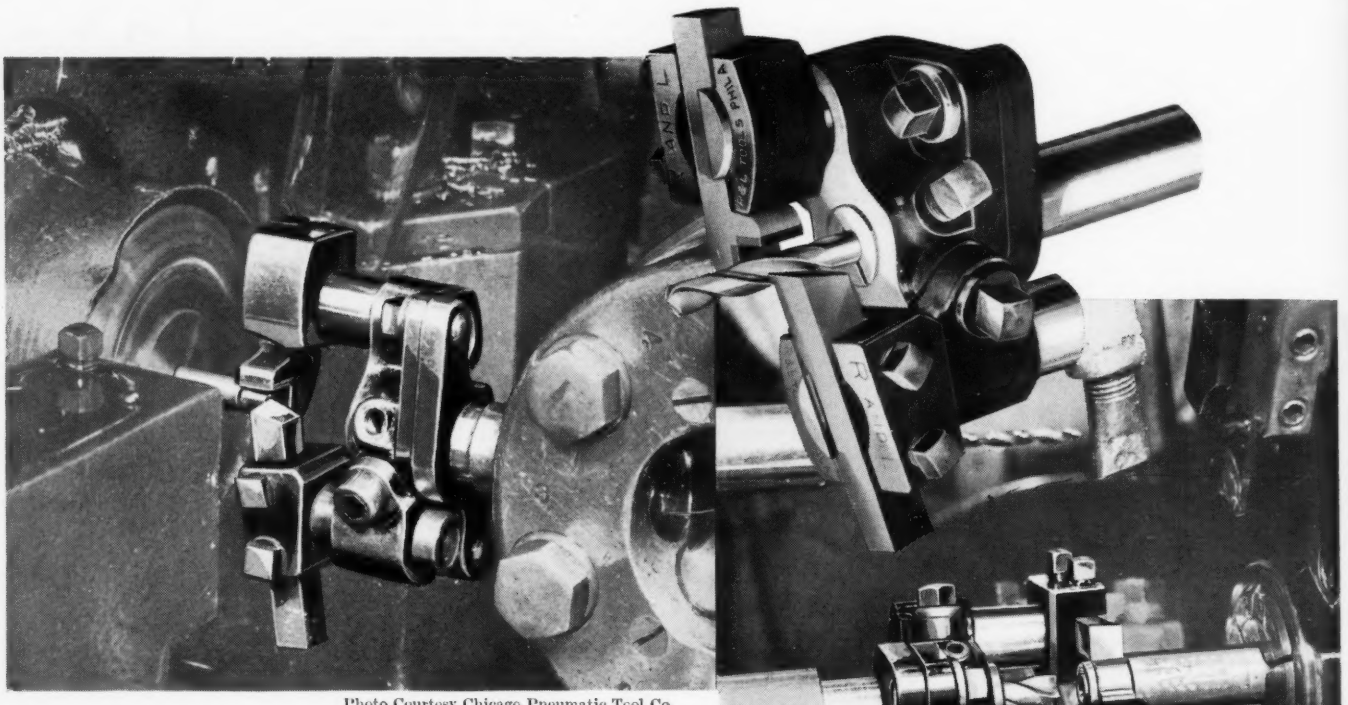
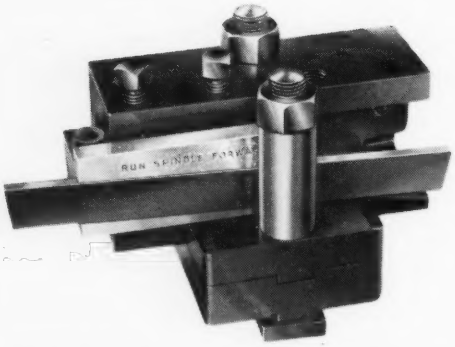


Photo Courtesy Chicago Pneumatic Tool Co.

HERE'S HOW R and L TOOLS INCREASE MACHINE CAPACITY



ANOTHER R and L TOOL!

The R and L Universal Tool Post holds square or flat tools, and provides means for adjusting the tool in all directions. Can be used on the front or back cross-slide with the spindle running either direction.

Small parts for Chicago Pneumatic Tools are machined to close tolerances in the set-ups shown here. And—to get extra production capacity—Chicago Pneumatic uses R and L Turning Tools. These versatile tools can double, or triple the capacity of any spindle or turret face by performing combinations of operations such as the ones illustrated on governor stop-pins and throttle plug bushings.

Ruggedly built and simple in set-up, R and L Turning Tools will produce accurately concentric work. They can be set up to do drilling and turning; turning, centering and burnishing; pointing and form turning; turning two diameters and other jobs at one work station, doubling or tripling the capacity of your automatics or screw machines.

The possibilities for using R and L Turning Tools are almost endless. Some interesting set-ups are shown in the R and L Booklet, which also gives complete specifications of the five sizes of R and L Turning Tools, and illustrates the other efficient tools in the R and L line. Write for your copy today. R and L Tools, 1825 Bristol Street, Nicetown, Philadelphia 40, Pa.

RIGHT R AND LEFT L TOOLS

TURNING TOOL—UNIVERSAL TOOL POST—FLOATING DRILL HOLDER—CARBIDE AND ROLLER BACKRESTS—REVOLVING STOCK STOP
TAP AND DIE HOLDER—CUT-OFF BLADE HOLDER—TURRET BACKREST HOLDER—RELEASING ACORN DIE HOLDER—KNURLING TOOL

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This Ryerson alloy inspector's signature completes a triple play for your protection—spark tester to laboratory metallurgist to inspector.

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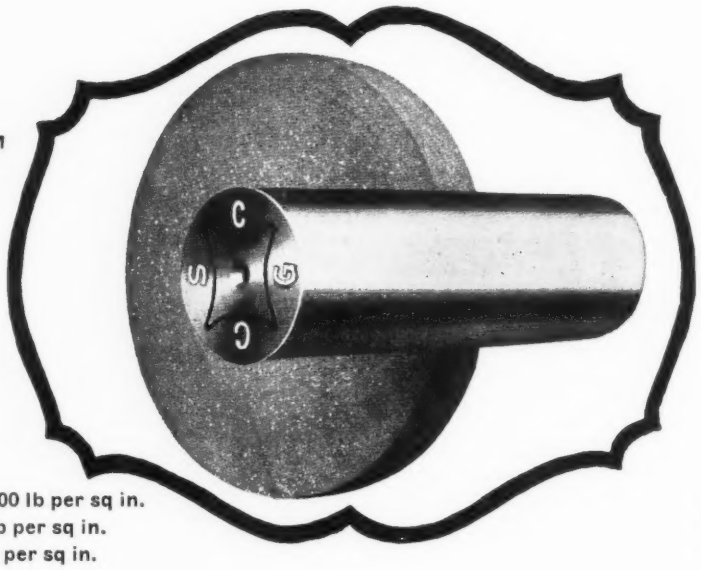

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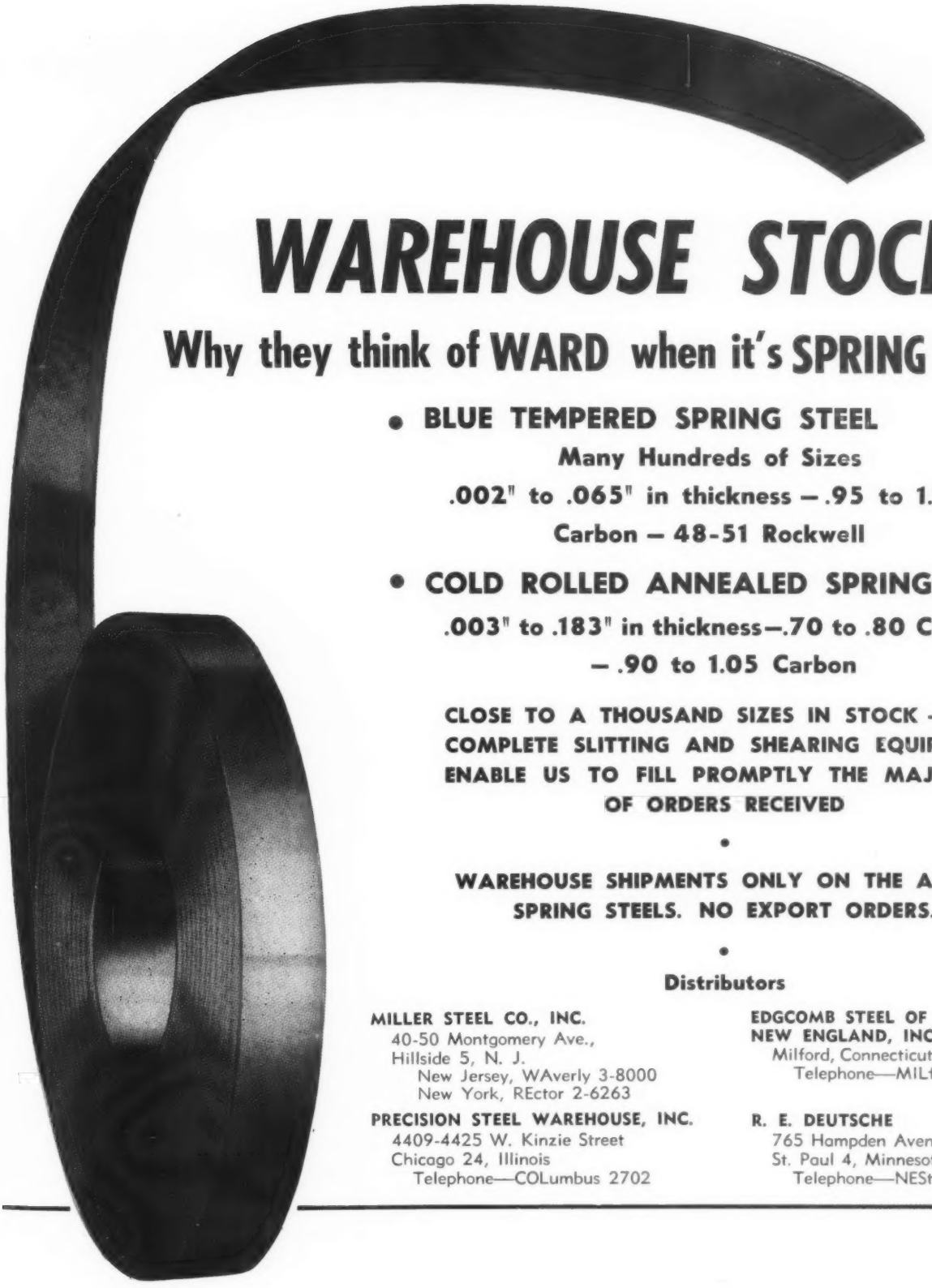

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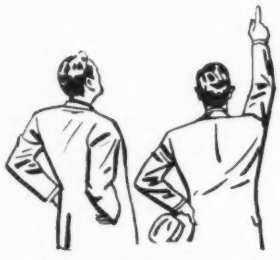

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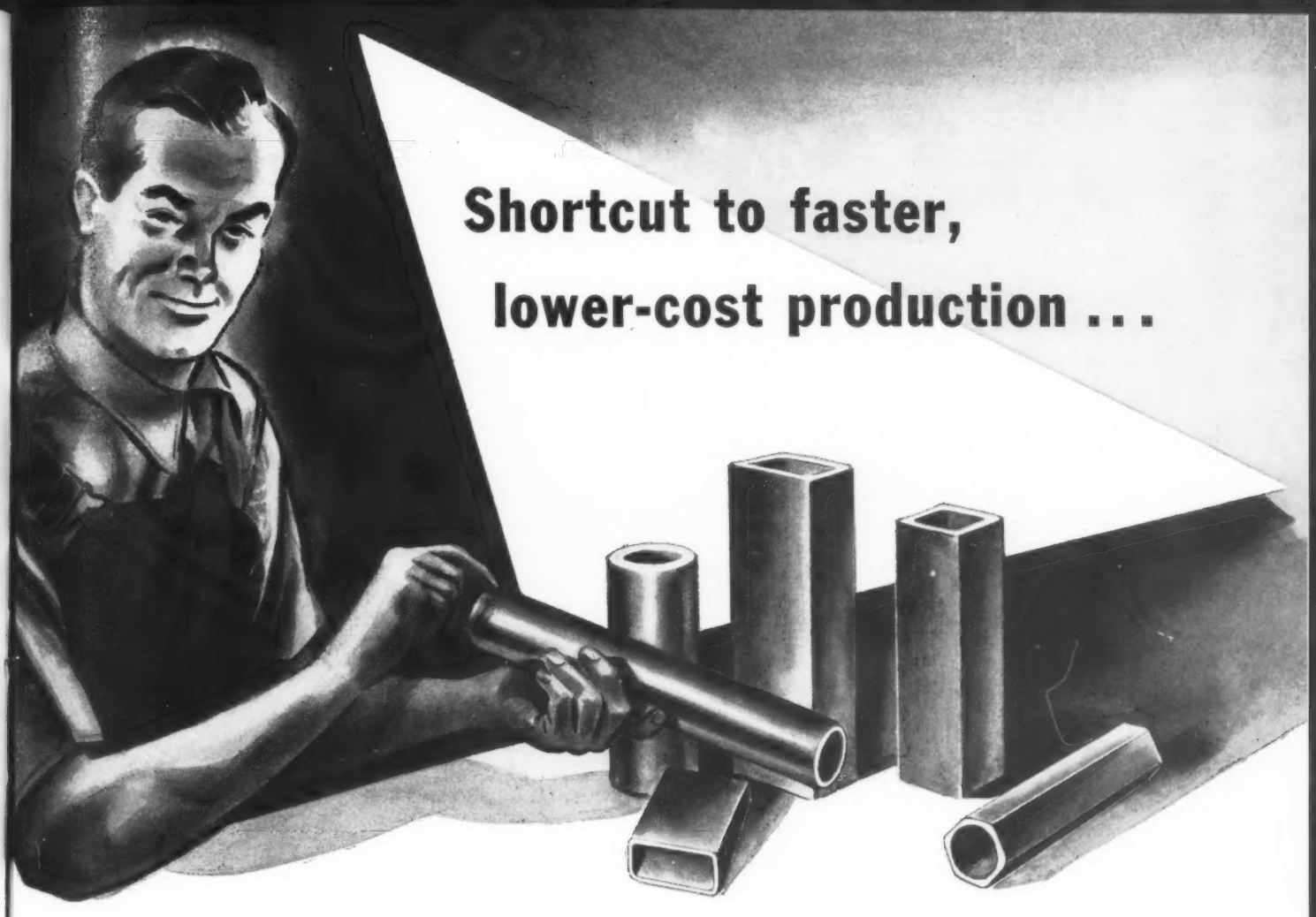


Shortcut to faster, lower-cost production . . .

you start out with the BASIC SHAPE ALREADY MADE *when you use* SHELBY SEAMLESS

SHELBY Seamless Steel Tubing comes to you ready for immediate fabrication or machining.

Made by NATIONAL Tube Company—the world's largest manufacturer of steel tubular products—it is obtainable, in addition to round, in square, rectangular, and other special shapes . . . in any commercial size from ⅜ to 10½ OD inches, and in wall thicknesses from .035 inch to 1.500 inch cold drawn . . . and in a wide range of steel grades and anneals.

By being able to start with pre-shaped stock instead of with castings or forgings, you eliminate or greatly reduce many time- and labor-consuming operations, as well as the costly waste of material.

But perhaps the biggest advantage in using SHELBY Seamless is that its excellent machining characteristics both speed up production and improve the quality of your output. You can turn out parts from it in the millions and the last part will be as metallurgically and dimensionally accurate as the first.

Why not talk to National's engineers about the possibility of using SHELBY Seamless? You, too, may be able to profit by their wide experience. And you can be sure that any recommendations they make will be based on a study of your particular requirements and the results of similar-condition tests in our own laboratories and actual on-the-job observations.

NATIONAL TUBE COMPANY, PITTSBURGH, PA.
(TUBING SPECIALTIES DIVISION)
COLUMBIA STEEL COMPANY, SAN FRANCISCO
PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

WALLS WITHOUT WELDS

USS

SHELBY SEAMLESS STEEL TUBING

UNITED STATES STEEL

NO FINER STEEL BARS HAVE EVER BEEN MADE

than Union

Ground Rounds...

...Use them where Split-Hair Accuracy, Arrow-Like Straightness, Roundness and a Mirror Surface are Needed

Here are the finest commercial steel bars that money can buy—in sizes from ⅛″ to 8″, inclusive—just the bars you may need to improve product quality or to cut costs.

Union Ground Rounds are extremely accurate. The standard tolerance of Cold Drawn and Ground Rounds (Union Special Finish) in sizes ⅛″ to 1⅞″, inclusive, is plus .000″, minus .002″. That of Turned and Ground Rounds (Union Precision Shafting) is plus .000″, minus .002″ in sizes 1⅛″ to 2$\frac{7}{16}$″, inclusive, and plus .000″, minus .003″ in sizes 2½″ to 8″, inclusive.

Since these tolerances always are *undersize*, Union Ground Rounds assemble readily—never require costly dressing down to fit.

Union Ground Rounds are uniformly straight and round, *too*—with a lustrous, smooth surface that minimizes friction and provides an attractive, bright finish.

With these fine steel bars you can assure:

1. **Perfect alignment of bearings, gears, cams, clutches and other moving parts;**
2. **Smooth, quiet, balanced operation in the most intricate mechanism;**
3. **Freedom from vibration at high speeds;**
4. **Reduced wear;**
5. **High Operating efficiency;**
6. **Longer service life;**
7. **Lower assembly, maintenance and per-year-of-service costs;**
8. **Attractive appearance.**

Union Cold Drawn and Ground Rounds provide the improved machinability and physical properties developed in cold drawing—while Union Turned and Ground Rounds may be machined unsymmetrically or threaded without warpage or distortion.

Both types can be produced in all standard and special carbon, alloy and stainless steel analyses. They can be furnished annealed, normalized, spheroidized, heat treated or strain relieved as required. Let us show you where Union Ground Rounds can benefit your product —and your costs.

REPUBLIC STEEL CORPORATION
Union Drawn Steel Division • Massillon, Ohio
GENERAL OFFICES • • • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

Republic

REPUBLIC STEEL REG. U.S. PAT. OFF.

US

UNION COLD DRAWN STEELS

REG. U.S. PAT. OFF.

Free-Machining Bessemer, Alloy and Enduro Stainless Steels

•

Union Cold Drawn Special Sections

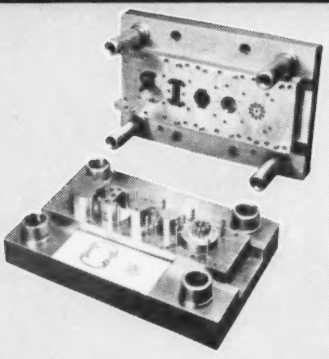
•

Union Cold Drawn and Ground Rounds; Turned and Polished Rounds; and Turned, Ground and Polished Rounds (Union Precision Shafting.)

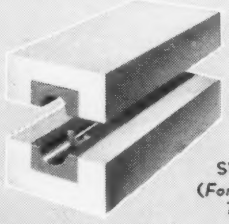
"50 Times Better"

Talide
(TUNGSTEN CARBIDE)
Drawing Dies

TALIDE METAL MEETS EVERY REQUIREMENT



PIERCING AND LAMINATION DIES



SWAGING DIES
(For Forming Solid and Tubular Shapes)

POWDER METALLURGY DIES *(For Compacting Powdered Metals and Materials)*

Talide Dies outwear steel dies 50 to 1. Production runs of over 1,000,000 pieces are commonly obtained. Long life of super-hard Talide Dies reduces down time, increases output, lowers unit cost and makes a better product.

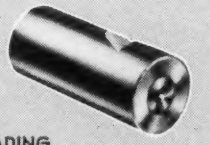
Tungsten Carbide Dies take and hold a brilliant polish, thereby imparting a better finish to your product.

Talide Metal Dies range in size from pin point to 24" I. D., and in many complex shapes . . . used for blanking, drawing, swaging, extruding, spinning or curling.

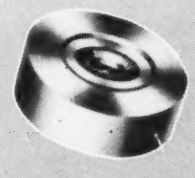
Send us prints or parts for estimate and recommendations and ask for Catalog 48-WP.

BLANKING AND FORMING DIES
(For Stamping Lamination Discs, Metals, Plastics, Paper)

TUBE MANDRELS



HEADING AND EXTRUSION DIES
(For Shaping and Sizing Bolts, Nuts, Screws and Collapsible Tubes)



DRAWING DIES
(For Wire, Tubing and Bar Stock)

SPINNING AND CURLING ROLLERS

SINTERED CARBIDES
METAL CARBIDES CORPORATION
MC TALIDE
YOUNGSTOWN, OHIO
HOT PRESSED CARBIDES

METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

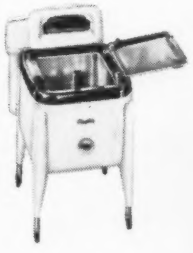
CUTTING TOOLS · DRAWING DIES · WEAR RESISTANT PARTS

This Railroad Car WINDOW SILL Idea Can Go Places!

❶ At a reduction in cost, The Budd Company has adopted BAKELITE Phenolic Plastic for the long-lasting window sills of its new streamlined passenger cars. The sills are molded in a single piece that requires no machining or finishing. The design purposely allows for a slight lengthwise bend, which straightens out when the ends are clamped in place, and gives each sill a permanent tension fit in its window frame. The sills are hard, smooth, lustrous and are highly resistant to water, temperature changes, and cleaning compounds. The molder is Northern Industrial Chemical Company.

Opportunities for you

in the expanding family of Plastics!



BAKELITE NEWS

NO. 5

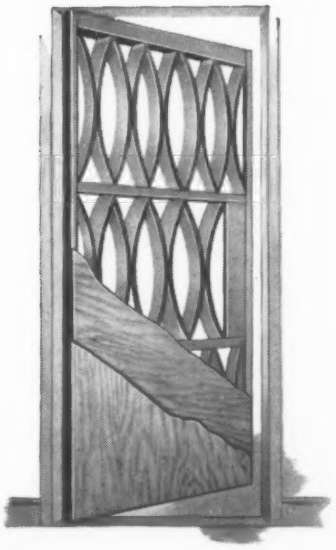
NOTES FROM BAKELITE CORPORATION ON BETTER, FASTER, LOWER COST PRODUCTION WITH "BAKELITE" PLASTICS

The SM-O-O-T-H-Y That Helps Safeguard Clothes!

❷ Agitators in the new Maytag Washers are made from a special type of BAKELITE Phenolic Plastic, bringing real benefits to manufacturer and housewife, alike. They're rapidly and inexpensively molded in a single operation to a degree of surface smoothness that is definitely kinder to fabrics. Light in weight, they are strong, attractively colored, and resistant to soap, detergents, hot water, and dirt. They're molded by the Plastics Division of General American Transportation Corporation, and by Chicago Molded Products Corporation.

What Can This DOOR Tell You About ADHESIVES?

❸ Bonded throughout with BAKELITE Urea Resin Glue BCU-12, this ingeniously designed flush-panel door made by Para Corporation is strong, light, good-looking and economically produced. It's another example of the growing trend to BCU-12 in the furniture, plywood and woodworking industries. For BCU-12 is highly extendible. It can be used for cold- or hot-pressing, curing rapidly at room temperature or up to 265 deg. F. A standardized product, it is suited to well-established gluing techniques.



PLEASE TURN THE PAGE

LAMINATED PLASTICS Set This Idea Soaring!

❹ Helicopter blades built by Goodyear Aircraft Corporation now have an ingenious new covering on the aft two-thirds of their surfaces. It consists of "Formica" laminated plastics made with BAKELITE Phenolic Resin, pressure bonded between thin sheets of stainless steel. The laminate not only provides a high degree of weather resistance, but also adds stiffness, greater weight-lifting ability, and maximum resistance to distortion under load.

Does Your Product Call for a "COLD-WEATHER" PLASTIC?

❺ In short, does it need rigidity and good mechanical strength at the low temperatures found in refrigerators? BAKELITE Styrene Plastics furnish these qualities in the baffle assembly that separates the freezer compartment from the storage section of Kelvinator's new "Moistmaster" Refrigerators. Moreover, these "cold-weather" plastics are light in weight, dimensionally stable, resistant to moisture and to food chemicals—and they save money! The baffle shown is molded by the Plastics Division of General American Transportation Corporation.

Bakelite
TRADE-MARK
PLASTICS

BAKELITE CORPORATION

BAKELITE CORPORATION
Unit of Union Carbide and Carbon Corporation UCC
30 East 42nd Street, New York 17, N.Y.

Design Changes Are Easy with Versatile, Adaptable Plastics!

Check coupon below for information on specific subjects illustrated. For general information write for copy of Booklet G-8, "A Simplified Guide to BAKELITE and VINYLITE Plastics."

BAKELITE CORPORATION, Department 14
30 East 42nd Street, New York 17, N. Y.

Please send information on subjects checked below:

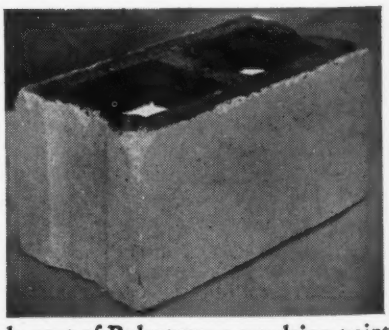
- ☐ 1. General-Purpose Phenolic Plastics
- ☐ 2. Impact-and-Chemical Resistant Phenolic Plastics
- ☐ 3. Urea Resin Glues
- ☐ 4. Phenolic Laminating Plastics
- ☐ 5. Molded Styrene Plastics
- ☐ 6. Polystyrene Emulsions

Your Name.....Title.....

Your Company.....

Address.....City.....Zone.....State.....

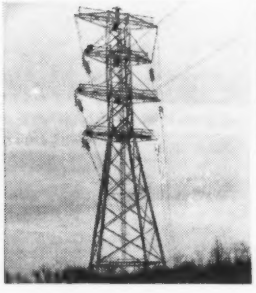
This Cement Block May Change Your Ideas About COATINGS



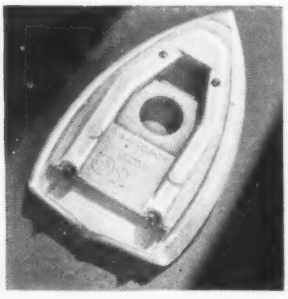
❻ There's something new in coatings that product designers, production managers, and maintenance men should investigate... **BAKELITE Polystyrene Emulsions.** The cement block illustrated tells the story. A test was devised in which only the *outside* surfaces of the block were given a single coat of Polystyrene emulsion paint. Then the block was filled with water for several months. The water traveled through the interior structure of the block, yet not a drop seeped through the coating... neither has the coating blistered nor peeled. These new BAKELITE Polystyrene Emulsions can be used straight or employed as a fortifying agent in standard types of water-thinned emulsion paints to improve gloss and washability. The exceptional "hiding power" of the new emulsions makes them serviceable for application on a variety of porous surfaces such as plaster, masonry, paper, cloth, wood and leather.

An industry born of electricity offers some suggestions . . .

Sound uses for ALCOA ALUMINUM in the electrical industry

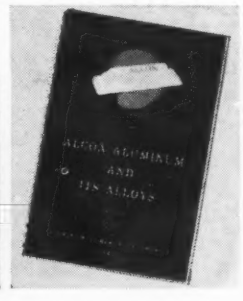


CONDUCTIVITY — Demonstrated in more than 50 years' use of Alcoa Aluminum as a conductor.



LIGHT WEIGHT—As important to industrial products, as it is to housewives in iron soleplates like this Alcoa Casting.

CORROSION RESISTANCE— As in bus bar installations, many of which have withstood the corrosive bite of industrial fumes and chemical attack.



TECHNICAL HELP—Write for free copy of "Alcoa Aluminum and Its Alloys", containing fundamental fabricating practices, design and mechanical data.

As one of America's larger users of electric power, Aluminum Company of America would naturally make wide use of Alcoa Aluminum in many electrical devices. Over the years, our plants and properties have been proving grounds for such uses of aluminum.

In Alcoa Aluminum Castings, like the wiring device shown above, we've learned there's a right design to take advantage of the strength, light weight, low cost and corrosion resistance of aluminum—and a wrong way: When poor alloy choice or improper design can result only in disillusionment for the manufacturer and dissatisfaction for his customers.

Alcoa stands ready today to work with electrical manufacturers toward the right choice of aluminum not for just satisfactory results; for excellent performance. When the world demand for aluminum no longer exceeds the supply, such teamwork should result in electrical products that are a credit to their manufacturers and to the Alcoa Aluminum they're made of. May we plan ahead with you? ALUMINUM COMPANY OF AMERICA, 664 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN **ALUMINUM**

REG. T. M. ALCOA ALUMINUM

Quick Delivery

JOHNSON BRONZE

Ledaloyl SELF LUBRICATING BRONZE

REG. U.S. PAT. OFF.

POWDER METALLURGY

● *Here is Good News* for manufacturers of all types of equipment. Now you can secure LEDALOYL bearings, bushings and parts . . . particularly in the smaller sizes . . . in *days* . . . not months. Our new and enlarged facilities . . . plus new equipment . . . plus new methods have made this prompt delivery possible.

Good delivery is but one of many reasons for specifying LEDALOYL. This new and unusual bearing material combines all of the best features of powder metallurgy. Our exclusive process of *pre-alloying* the basic materials . . . casting copper, tin and lead into a high quality bearing bronze alloy *prior* to manufacturing . . . provides a uniform structure with uniform strength and uniform porosity. Thus, the self-lubricating action is both constant and dependable.

LEDALOYL is low in cost. This is particularly true when there is quantity of a size. Each bearing, bushing or part is molded, under pressure, to required size and shape. This eliminates all expensive machining operations. Why not check over your needs today? Give us the opportunity to show you how to save both time and money. There's a Johnson Bronze office as near as your telephone.

JOHNSON BRONZE

SLEEVE BEARING HEADQUARTERS

The MOST COMPLETE SLEEVE BEARING SERVICE in the WORLD

520 S. MILL STREET NEW CASTLE, PA.

TIMKEN® tube engineering service guarantees clean-up with

MINIMUM MACHINING TIME AND SCRAP LOSS

SELECTING the right size seamless tube to make hollow cylindrical parts is not as simple as you might think.

Sometimes you may find you have tubing on hand which requires too much machining—wastes material and time. And sometimes you don't have *enough* metal to fill out your dimensions.

How to be sure of getting the *right* size tube? Consult with Timken. Timken tube engineering service will analyze the specifications for your finished part and recommend the most economical size Timken tubing for the job. Chances are it will be a lighter weight tube than you're using now . . . with a sizeable saving in material cost.

You get the saving—we take the risk

We take all the risk! We *guarantee* that the Timken tube we give you will clean up to your finished dimensions!

Timken tube engineering service can save you material and machining time, and give you guaranteed clean-up for three main reasons:

First, one of our engineering departments devotes its full time to the calculation of the most economical tube size for your particular requirements. These men have had years of contact with mechanical tubing problems in practically every large scale manufacturing industry.

Second, every step in the manufacture of Timken tubing is rigidly controlled in our own mills, resulting in outstanding uniformity of dimensions. This greater uniformity permits a minimum stock removal in the Timken tubing you use.

Third, Timken has the largest assortment of roll sizes of any mechanical tubing mill in the country. This means you have the largest selection of hot-rolled tube sizes to choose from.

90% of Timken tubing bought this way

So fully proved and widely recognized are the advantages of Timken tube engineering service that today 90% of Timken mechanical tubing is bought on that basis.

Let Timken tube engineering service make an analysis of your requirements and recommend the most economical size tube for your job, guaranteed to clean up. No cost or obligation. Simply provide the data indicated below to The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

All you have to do is give us this information:

1. **FINISHED PART DIMENSIONS.** Maximum OD x Minimum ID x Length. Blue print or sketch preferred. Dimensions should include applicable tolerances and should be identified as "finish machined" or "finish ground".
2. **MACHINING POSITION.** Complete sequence of operations when practical.
3. **CONDITION DESIRED.** Hot rolled, cold drawn, rough turned, or rotorolled.
4. **GRADE AND QUALITY OF STEEL.**

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

TIMKEN

TRADE-MARK REG. U.S. PAT. OFF.

Fine Alloy

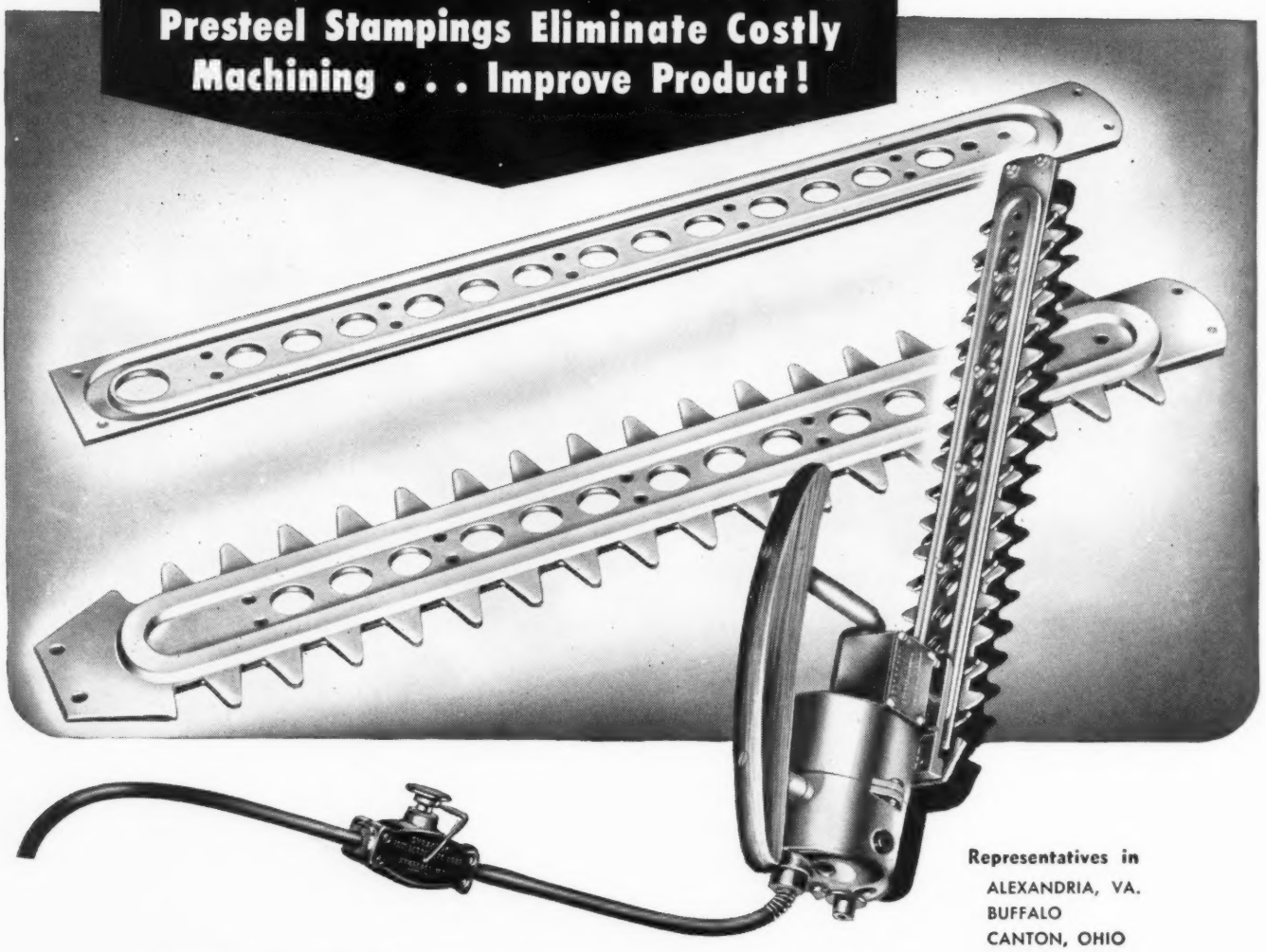
STEEL

and Seamless Tubes

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing.

STRONGER PARTS AT LOWER COST!

Presteel Stampings Eliminate Costly Machining . . . Improve Product!



The cutter bar and chain cover for this power hedge shear graphically illustrate how Presteel combines craftsmanship and expert tool design with modern methods and equipment to produce stronger metal parts at lower cost.

Identical grooves in both parts are required, to a depth 50% beyond thickness, to permit free passage of the speedy chain. Previously, these grooves were machined, but removal of the metal weakened the structure.

Presteel accurately forms and pierces these large area parts on heavy presses from .125 cold rolled annealed steel. By coining the grooves, the metal is forced back into the parts — hardening, toughening and increasing their strength. Through proper tool design, Presteel controls the flow of metal to form the sides of the grooves, sharp and square — perpendicular to the face. Machining is entirely eliminated.

Manufacturers are looking to Presteel for assistance in the design and redesign of metal stampings that will reduce production costs. Perhaps you have a problem where our metal working knowledge will save you money! Tell your story to our representative or write us direct!

Representatives in

ALEXANDRIA, VA.
BUFFALO
CANTON, OHIO
CHICAGO
DENVER
DETROIT
FORT WORTH
INDIANAPOLIS
LOS ANGELES
NEW YORK
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ALLOY STEELS AND OTHER METALS COLD FASHIONED SINCE 1883

WORCESTER PRESSED STEEL CO.

302 BARBER AVENUE
WORCESTER 6, MASS.

Turn to INGERSOLL when you need—

Special Steels FOR Special USES

ENGINEERING B-W PRODUCTION

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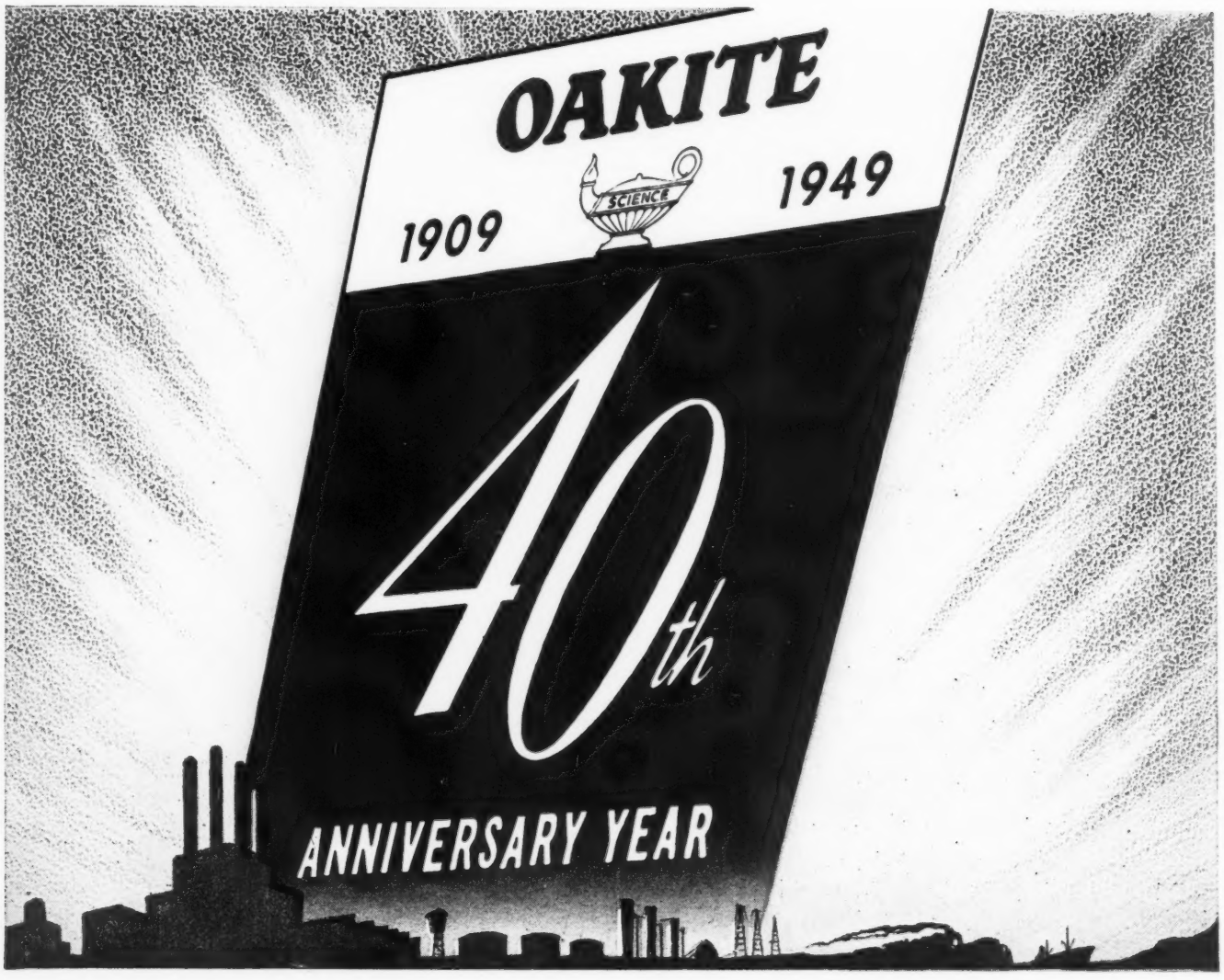
Tillage Steels • Soft Center Steel • Shovel Steels
Knife Steels • Saw Steels, including Hack Saw
Blade Steels • TEM-CROSS Steel • Stainless Steels
INGACLAD Stainless-Clad Steel

INGERSOLL STEEL DIVISION

Borg-Warner Corporation, New Castle, Indiana • Plants: New Castle, Indiana; Chicago, Illinois; Kalamazoo, Michigan



Who can foretell... the far-reaching benefits new Oakite cleaning methods will bring to tomorrow's metal-working operations?

We live in fast-moving times.

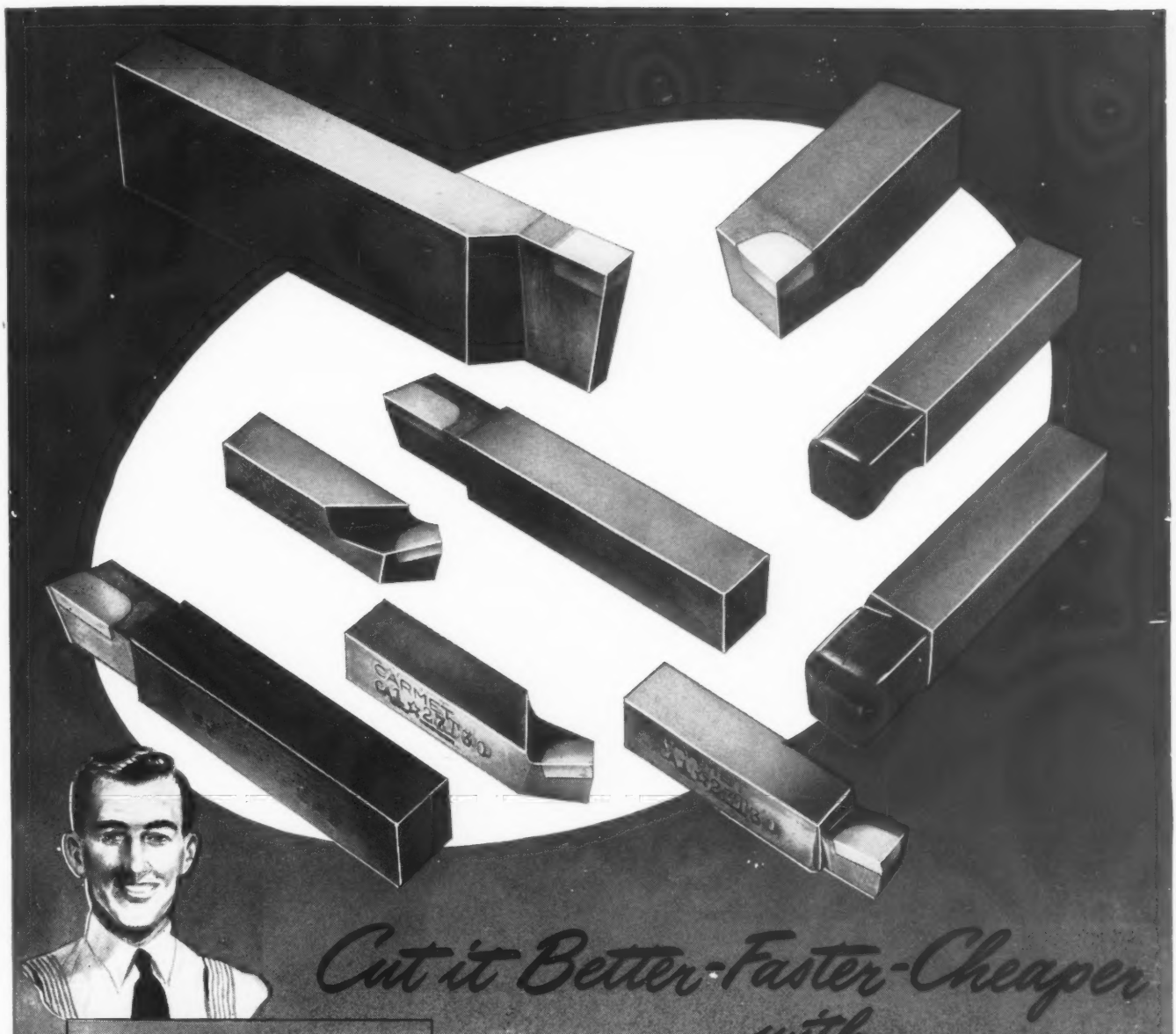
Four short decades ago, when industry first employed Oakite materials to improve upon old-fashioned soda-kettle washing practices, it little realized the startling progress that industrial cleaning was destined to achieve. Nor could it conceive how Oakite methods and service would contribute to the unerring precision, efficiency, and amazing speed required in today's streamlined manufacturing operations.

The record speaks for itself. Today, industry knows it can depend upon modern Oakite materials, methods and service to keep production volume at high levels . . . to keep unit costs low . . . to obtain uniform, durable, attractive product finishes that promote sales.

But production cleaning and its related techniques cannot be permitted to rest on past or present accomplishment. So the Oakite Engineering, Technical and Chemical Research Staffs are even today creating, testing and perfecting tomorrow's materials and methods that will contribute greatly in helping the metal-working industry reduce manufacturing costs in the years ahead. Oakite Products, Inc., 21A Thames Street, New York 6, N. Y.

Oakite Technical Service Representatives Are Located in All Principal Cities of the United States and Canada

OAKITE
REG. U.S. PAT. OFF.
INDUSTRIAL CLEANING MATERIALS • METHODS • SERVICE



Cut it Better-Faster-Cheaper with

CARMET

Carbide Tools

What other jobs have you for **CARMET** *to do*

We specialize in precision preforming of Carmet carbide metals to *any* shape for special wear-resistance needs, such as dies, gage blanks, etc. Let us quote on *your* requirements.

The Allegheny Ludlum line of Carmet Carbide Tools is *complete* —every style, size and grade you may need for any cutting job in the shop. If you make your own tools, a full line of blanks is available, too—as well as all necessary sizes of A-L Shank Steel. Extensive stocks of Carmet standard tools and blanks are carried in A-L and Distributor's warehouses coast to coast, and special tools are available to order. ● - Just remember, for best performance on any application, *use Carmet!*

Allegheny Ludlum Steel Corporation

CARBIDE ALLOYS DIVISION, Detroit 20, Michigan

W&D 813

DISTRIBUTORS: Write us about handling CARMET Standard Tools in your territory.

8 MODERN FOUNDRIES

(Coast-to-Coast Service)

PLUS **The 1949 advantages of Aluminum Castings by Alcoa**

Compare the cost of finished products when you think of castings by Alcoa! Held to close tolerances, they require minimum finishing from as-cast. And their light weight means lower handling costs through your production line.

Alcoa produces sand, permanent, and semi-permanent mold castings. For more information and a prompt quotation, call your nearby Alcoa sales office (branches in 55 cities) or write ALUMINUM COMPANY OF AMERICA, 1748 Gulf Bldg., Pittsburgh 19, Pa.

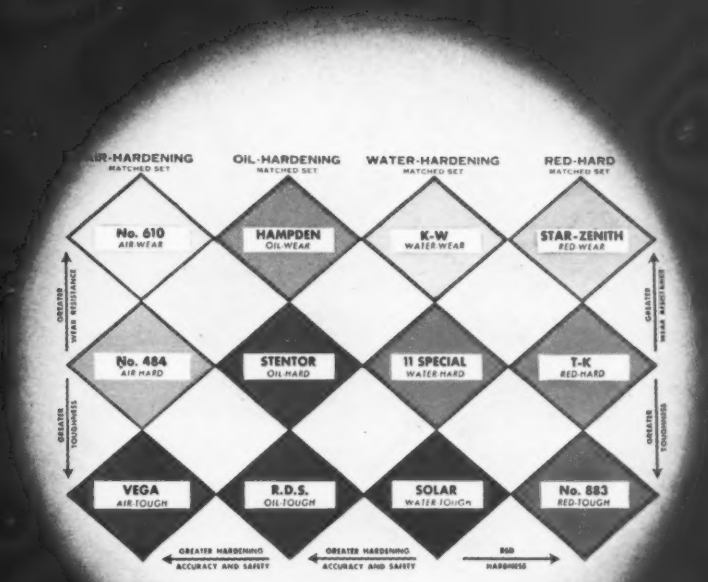
Sand and Permanent-mold Foundries at Bridgeport, Conn., Cleveland, Detroit, Los Angeles

ALUMINUM CASTINGS *by* ALCOA

ALCOA ALUMINUM

New!

a quick, positive way to identify tool steel bars!



NOW . . . CARPENTER MATCHED TOOL & DIE STEELS ARE PAINTED FULL LENGTH!

at last you can

- Quickly Identify Steels In Stock
- Reduce Your Own Marking Costs
- Eliminate Costly Stock Mix-Ups
- Simplify Inventory-Taking

Discover how this new marking system can help you . . .

THE CARPENTER STEEL COMPANY • READING, PA.

SEE OTHER SIDE

This New Marking Program Gives You

4 NEW WAYS TO REDUCE TOOLING COSTS!

1. QUICKLY IDENTIFY STEELS IN STOCK! No more "guesswork" when selecting steels from stock. Every Carpenter Matched Tool and Die Steel is now painted end to end with its own distinctive color.

2. REDUCE YOUR OWN MARKING COSTS! With this new marking method the identifying color stays with small pieces cut from bars, and on short lengths put back into stock.

3. AVOID COSTLY STOCK MIX-UPS! At last you can reduce the danger of using the wrong steel for the job—and ruining an otherwise perfect tool or die.

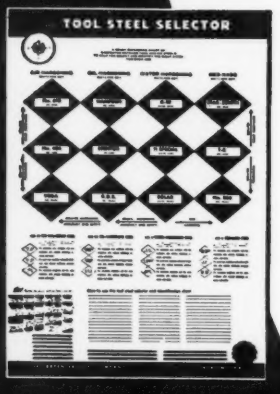
4. SIMPLIFY INVENTORY-TAKING! By knowing at a glance "which steel is which" you can speed-up inventory-taking, eliminate confusion in stocking, and reduce time spent handling tool steels.

NOW . . . A Complete, Simplified Program to Help You Get Better Tools and Dies!

Here, for the first time, is a complete program that helps you take the guesswork out of selection, identification, and heat treatment of tool and die steels. For many years tool makers have used the Carpenter Matched Set Method to simplify tool and die steel selection and heat treatment. Now going one step further, Carpenter's new bar painting system is your insurance against "mistaken tool steel identity". Each "diamond" on the new 12-color Wall Chart represents a steel in the Matched Set. By following directional arrows—"North" for extra wear resistance, "South" for greater toughness, etc., you quickly arrive at the one steel best suited for each job. Simply use the Chart to select the steel you need—then go to your stock rack and pick out the bar with the corresponding color. It's easy, saves time, reduces costs.

Start now to cash-in on all the exclusive benefits you get with Carpenter Matched Tool and Die Steels. Be sure your orders call for "Carpenter". Meanwhile, write for your Tool Steel Selector and Identification Wall Chart, now.

The Carpenter Steel Co., 105 West Bern St., Reading, Pa.



The new 21"x30" Tool Steel Selector Wall Chart now printed in 12 different colors to quickly identify each Carpenter Matched Tool and Die Steel.

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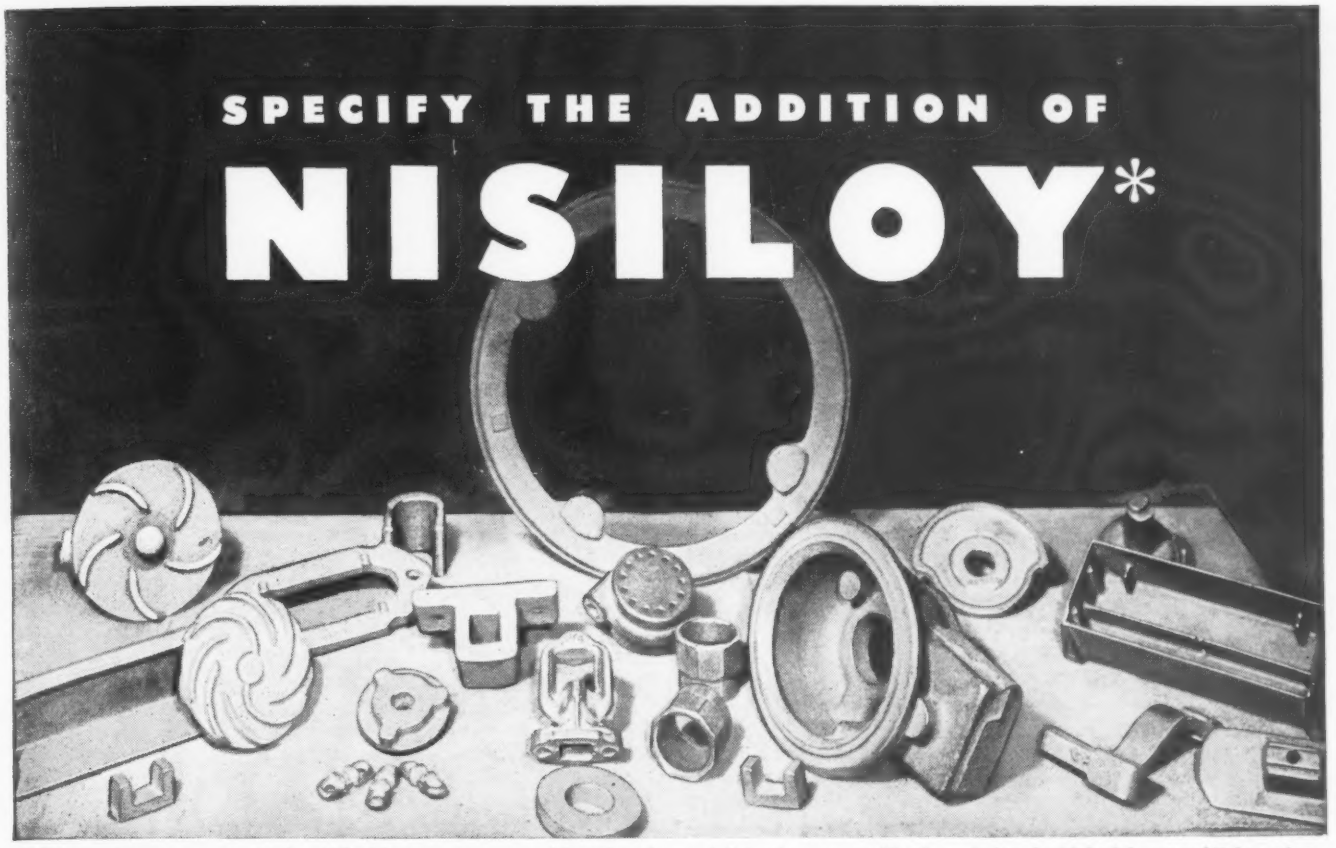
Carpenter MATCHED TOOL & DIE STEELS

Painted Bars in Stock — Ready for Immediate Delivery!

Atlanta, Baltimore, Birmingham, Ala., Boston, Bridgeport, Conn., Buffalo, Chicago, Cincinnati, Cleveland, Dayton, Detroit, Grand Rapids, Mich., Hartford, Houston, Indianapolis, Kansas City, Los Angeles, New York, Philadelphia, Providence, St. Louis, Worcester, Mass., In Canada: Toronto, Montreal

Export Department, 233 Broadway, New York 7, N. Y. "CARSTEELCO"

SEE OTHER SIDE



Chilling and consequent machining difficulties were encountered by a foundry specializing in cast parts like these, designed with both heavy and light sections. Nisiloy, added to the ladle, assured ready machinability after many other experiments failed.

for Better Machinability in GRAY IRON CASTINGS

Casting users profit from use of Nisiloy . . . a new, powerful, positive inoculant that promotes better machinability. It contains about 60 per cent nickel, 30 per cent silicon, balance essentially iron.

Faster, easier, lower-cost finishing of gray iron castings may be attained because Nisiloy serves to eliminate localized hard areas or chilled (white) edges and surfaces . . . regardless of sharp variations in section thickness.

EMBLEM OF INCO SERVICE
TRADE MARK

Get full information. Send for *your* free copy of a booklet that describes how the dense, gray, machinable structure secured with Nisiloy reduces machining time, tool wear, rejects and costs. Mail the coupon now.

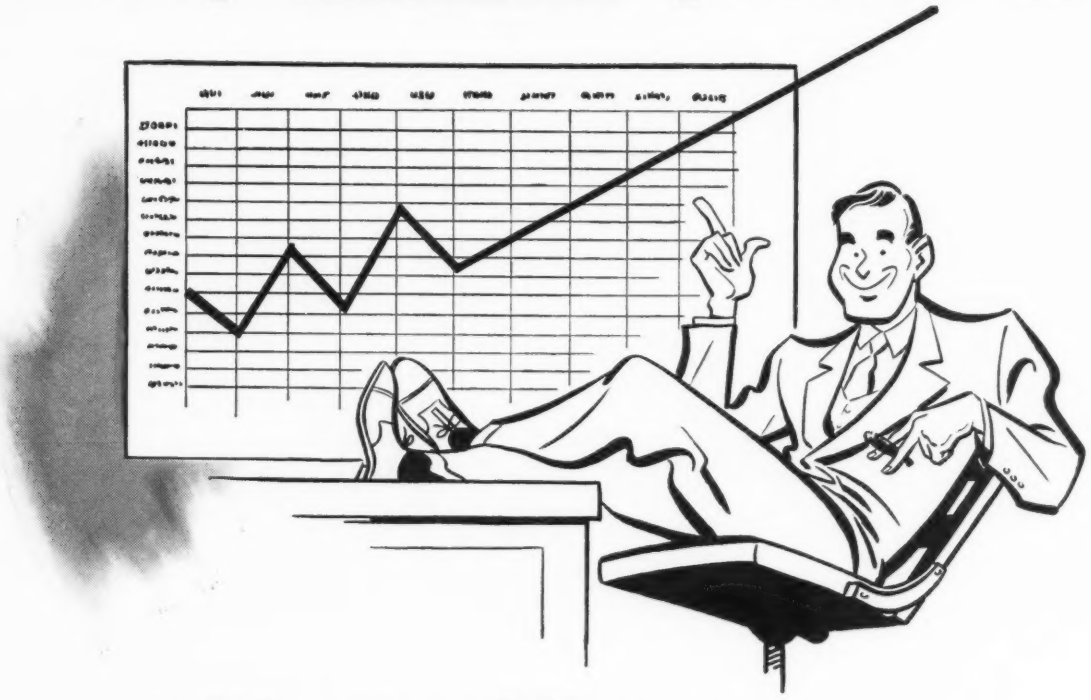
*Trade-mark of the International Nickel Company, Inc.

The International Nickel Company, Inc.
Dept. M., 67 Wall Street, New York 5, N. Y.
Please send me your booklet entitled
"NISILOY" for GRAY IRON CASTINGS.

Name.....*Title*.....
Company.....
Address.....
City.....*State*.....

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

And they doubled production—



without adding men, materials or machines:

HOW WOULD you like to see:

Your production of pieces per tool grind upped 300%? Rough grinding operations eliminated? One lathe replace four? Work speeds quadrupled and finishes improved at the same time? More work squeezed from your machines? Troublesome wear problems licked? The parts you make held to extremely close tolerances?

Get these results with Carboloy Tools

In the manufacture of dairy equipment, a simple change to Carboloy Cemented Carbide brought *every one of these advantages.*

As a result, production more than doubled . . . and in spite of nearly a 16% raise in hourly labor rate, and substantial increases in material costs, cost per piece was *not* increased.

How can you get these results?

The benefits of Carbide can apply to your operations, too. And there's one sure way to find out how: *call in a Carboloy engineer.* He has come up against almost every kind of carbide problem, and can bring to your plant his wide knowledge and experience in getting the most from carbides.

His specialized knowledge of carbides, together with the intimate knowledge your engineers have of your particular production problems, will be able to cure many of your production ills . . . even if you're already using carbides to some extent.

Call in your Carboloy engineer

He'll gladly help you—for that's his job. He can assist you, too, in the selection of the most economical tooling from any of Carboloy's 600 standard tools and blanks, or special Carbide-tipped tools made by more than 150 tool manufacturers.

So why not get in touch with him?—or write us direct:

CARBOLOY COMPANY, INC.
11147 E. 8 Mile Ave., Detroit 32, Michigan

AUTHORIZED CARBOLOY CEMENTED CARBIDES DISTRIBUTORS

Standards stocked by authorized distributors in 82 cities coast to coast.

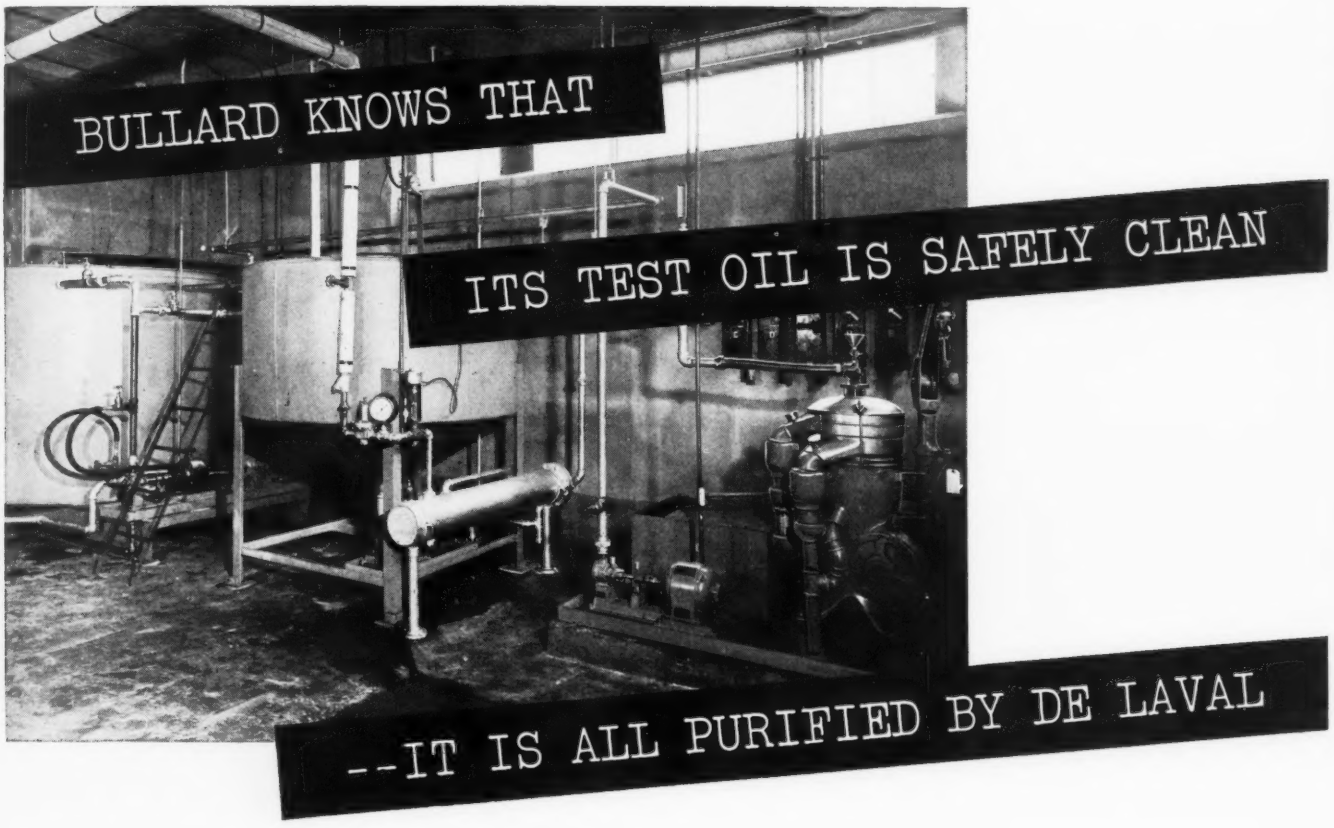
CARBOLOY®
CEMENTED CARBIDE

If precision is your problem, sleeve bearings will solve it to the fullest extent... In modern aircraft engines and their superchargers—on the spindles of precision machine tools—where precision is paramount—Bunting Cast Bronze sleeve bearings are used... Versatile in design and alloy, Bunting Bearings offer advantages which we would like to discuss with you. The Bunting Brass & Bronze Co., Toledo 9, Ohio. Branches in Principal Cities.

Bunting

BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS

42



NEVER in the whole life of a machine tool is cleanliness of greater importance than when the machine tool or its component functional parts are tested.

The Bullard Company insures that all hydraulic oil used in testing its famous "Mult-Au-Matic" and other machine tools is centrifuged in the De Laval Oil Purification System. Being wholly mechanical in action, De Laval machines remove by centrifugal force all undesirable solids, but do not remove rust inhibitors.

De Laval Oil Purifiers when used to maintain test oils insure more ***reliable*** tests, just as De Laval Oil Purifiers used to keep many other kinds of factory oil in condition save maintenance expense and add to machine life. Often, as in the case of cutting oil, De Laval purification leads ultimately to better work—less rejects—as well as to longer cutting oil life.

Write for Bulletin MM-1 and check the application for De Laval Oil Purifiers ***you*** are most interested in.

●

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL

PURIFIERS and CLARIFIERS FOR FACTORY OILS

Save more than the oil
• Save work!
• Save tools!
• Save machines!

Life-Line

NOW... LUBRICATED for LIFE

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

do away with lubrication costs

FOREVER

Forget old-time ideas about the care and greasing needed to keep motors running!

Life-Line motors now eliminate the time and cost required for lubrication—for life! Life-Line double-width ball bearings are prelubricated with a more-than-ample supply of specially-treated lubricant—and factory-sealed to keep dirt out and grease in, for *the life of the bearing.*

Periodic weekly or monthly greasing schedules can be dispensed with. Motors may be installed in inaccessible locations; machines no longer need be disassembled to reach motors for greasing. Winding failures caused by overlubrication, and failures caused by use of improper lubricants, can be prevented.

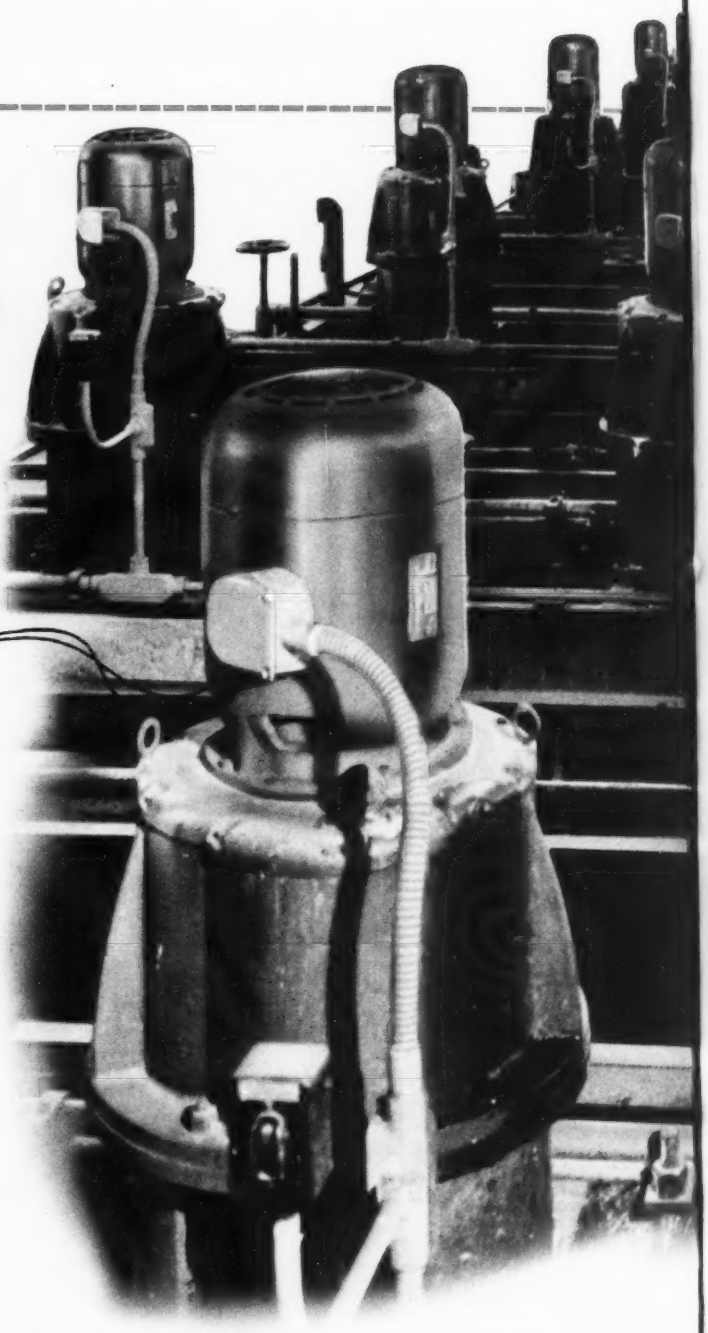
Multiply these advantages by the number of motors in *your* plant. You'll find they offer new and important savings—in labor costs, in machine down-time, in motor outage costs. Then get in touch with your nearest Westinghouse office today. Most standard Life-Line motors are now available from stock. Others are available on short delivery schedules. Ask for details on your requirements. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

Westinghouse

Life-Line Motors

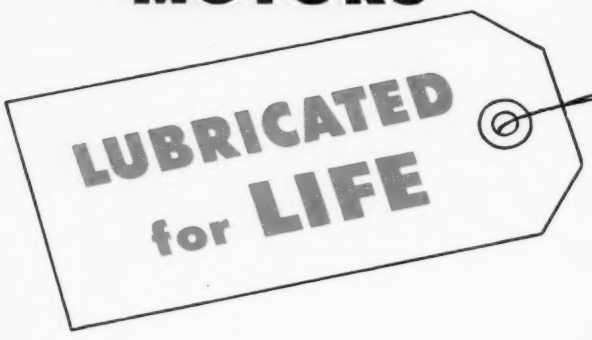
YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Tough lubrication job?

NOT WITH MOTORS



It costs money to "baby" electric motors with constant greasing attention, whether it's a few or a few hundred.

That's why Life-Line motors offer new and important savings in plants like this one using 119 Life-Line vertical motor drives, and in any others using a-c motors from 1 to 50 horsepower.

Life-Line motors cut down operating costs every day, every week, they are in service, because they need *no* lubrication—*for life.* Sealed, pre-lubricated bearings insure long life—reduce motor outages caused by overlubrication and underlubrication—reduce machine shutdowns and lost production.

Check your Westinghouse representative today for prices and delivery on your requirements. Standard ratings available from stock—others on short delivery. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-21494

Westinghouse

Life-Line

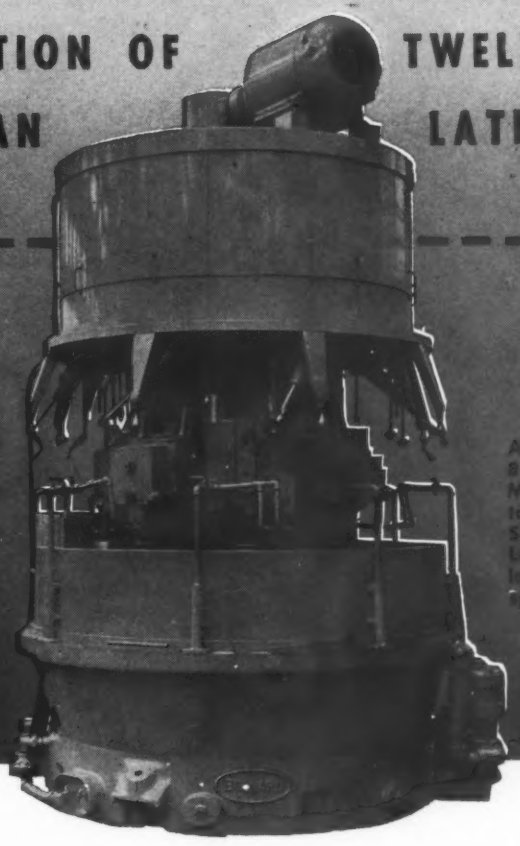
Motors

Litho in U. S. A.

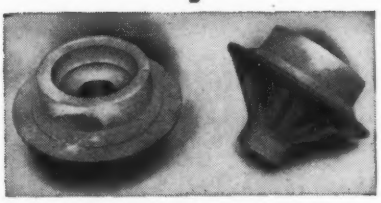
THIS ONE MACHINE

EQUALS THE PRODUCTION OF TWELVE TO FOURTEEN CAPSTAN LATHES

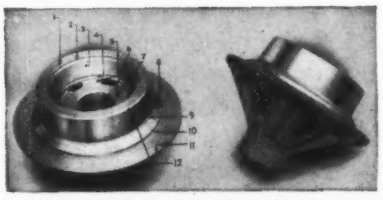
From Coventry, England, comes this enthusiastic report of the Standard Motor Co., Ltd., on the BULLARD Type D Mult-Au-Matic.



A BULLARD Type D 8-Spindle Mult-Au-Matic used in the up-to-date plant of the Standard Motor Co., Ltd., Coventry, England. Note the compact, space-saving design.



The work. A cast differential gear case, before machining.

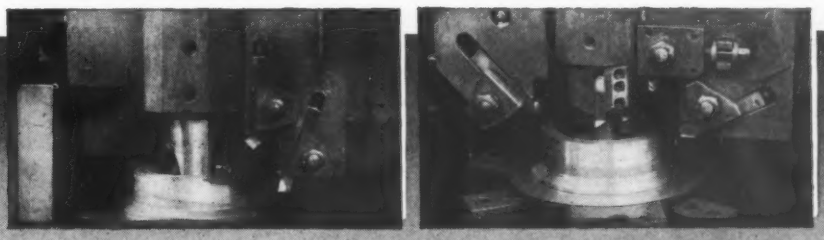


The same casting after completing one cycle (through 7 work stations) on the BULLARD machine. Arrows indicate the 12 machined faces . . . . Piece time: 2 minutes!

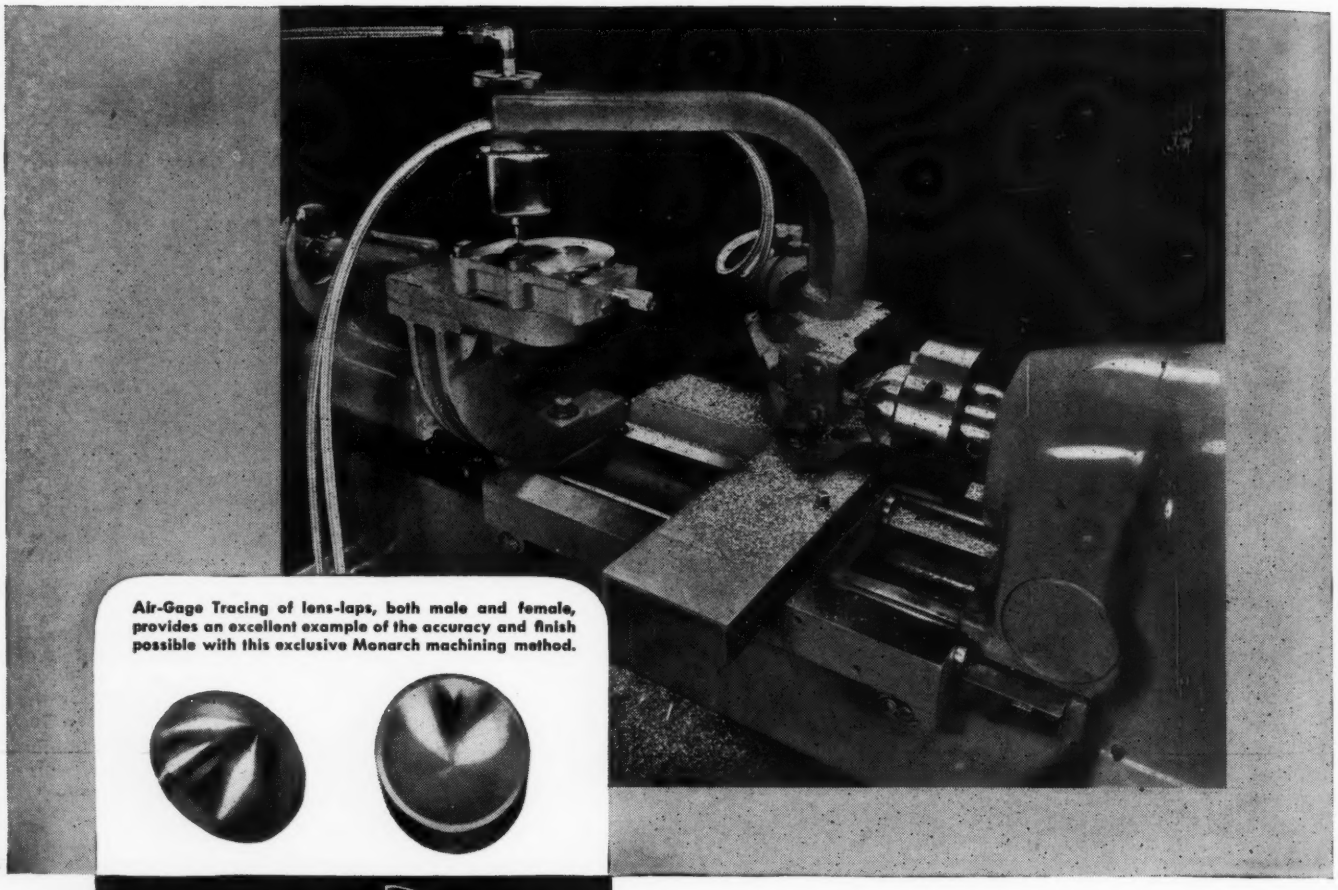
According to a leading British automobile manufacturer, the BULLARD 8-spindle Mult-Au-Matic is an excellent example of modernization of production machinery . . . with particular emphasis on its ability to perform 12 machining operations — entirely automatically — in 2 minutes' piece time! Case histories show why BULLARD Mult-Au-Matics are internationally recognized as outstanding among multi-spindle manufacturing equipment . . . key factors in the present world-wide effort to cut the time and costs of production.

BULLARD Mult-Au-Matics are rugged versatile machines designed to cut manufacturing cost on a wide variety of jobs. These are not exclusively high production machines since case histories show reduced manufacturing costs on short runs of work. Individual speeds and feeds at each station provide correct cutting conditions for various diameters, operations and a wide variety of cutting tools. Study the manufacturing economics of the Mult-Au-Matic Method as applied to your work. *The Bullard Company, Bridgeport 2, Connecticut.*

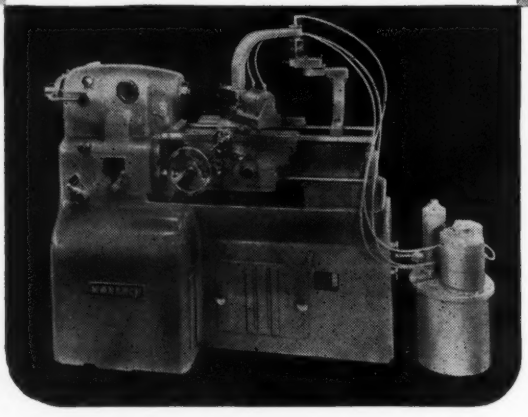
Send prints of your jobs for engineering estimates. Refer to ad MD 122



Close-ups of 2 of the 7 fully automatic work stations, showing several tools cutting simultaneously.



Air-Gage Tracing of lens-laps, both male and female, provides an excellent example of the accuracy and finish possible with this exclusive Monarch machining method.



NOW!

All the Advantages of AIR-GAGE TRACING Available for SMALL, HIGH-SPEED WORK

● Here's a new Monarch high-speed contour turning team to *push your costs way down.*

The proved advantages of Air-Gage Tracing now are available on the famous Monarch high-speed 10″ EE Precision Manufacturing Lathe.

By the exclusive Air-Gage Tracing method you can turn step shafts; turn, bore and face contours of innumerable kinds. This is done in a fraction of the usual machining time, at a fraction of normal costs—*and with better accuracy and finish.*

Air-Gage Tracing provides an automatic machining cycle and automatic sizing. All cutting is done with a single-point tool and over a wide, stepless range of cutting speeds. Accuracy is assured by the air-gage-like action of the tracer mechanism. Finish is improved; setup time and tooling costs greatly reduced by the single-point cutting method.

If you want peak production at a profit, then you'll want Air-Gage Tracing for your small-parts machining operations. Let us supply you with complete details.

ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

THE MONARCH MACHINE TOOL CO., Sidney, Ohio

FOR A GOOD TURN *FASTER*—TURN TO MONARCH

THEY MAY LOOK ALIKE . . . *but there's a difference!*

Mark of Antonius Stradivarius, Cremona, Italy . . . 1719

Mark of distinctive workmanship and quality

While both violins may look alike to the camera's eye, one is a rare instrument . . the other, a clever copy Actual comparison by a trained musician will show a vast difference in quality and value!

THERE IS A DIFFERENCE IN TAPS, TOO!

All taps may look alike at first glance, but the inherent, built-in quality of BATH ground thread taps is evident by their outstanding, every-day performance. Bath taps are ground from the solid AFTER hardening . . . are available in stock sizes or custom built for special uses.

For instance, if you're having trouble tapping stainless steel, there's a BATH tap, especially ground and engineered to speed production and decrease the threading cost of this hard-to-work metal. Why not investigate this special tap . . . or, write us about your particular threading problem today? Our experience is yours for the asking!

INSIST ON BATH TAPS . . PROFIT BY THEIR PLUS-PERFORMANCE!

PLUG AND RING THREAD GAGES · GROUND THREAD TAPS · INTERNAL MICROMETERS

JOHN BATH CO. INCORPORATED

24 Grafton St., Worcester, Mass.

NEW!

Weld Flux Chipper

CP-455-L with lever throttle and quick release retainer. Push type throttle handles available.

with a high velocity jet blow

This new CP-455 Pneumatic Chipper has a built-in high velocity air jet which cleans off the work surface as though a blow gun were built into the tool.

A new type of non-wearing "Pulley-valve" and throttle regulate the force of the blow from a tap to a heavy hammer-stroke, making the CP-455 an all-purpose scaler. Ideal for chipping weld flux, paint, rust, scale, soot and dirt, and a dozen other applications. Immediate delivery. Write for Bulletin SP-2089.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

THE BEST OF INSPECTION EQUIPMENT...

Photograph courtesy The Abdite Gauge Co., Dearborn, Michigan

Inspecting tiny six-spline ring gauges at 100 magnifications on a Jones & Lamson Optical Comparator and Measuring Machine. All tolerances plus or minus .0002".

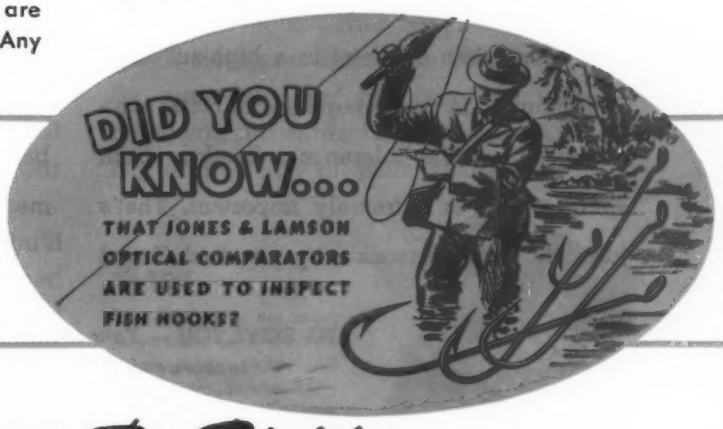
The finest workmanship can only be gaged by the finest inspection equipment. The Abdite Gauge Company, maker of precision gauges, uses a Jones & Lamson Comparator to inspect these tiny six-spline gauges. The splines are .028" wide and all dimensions are held to .0002". Any departure from these close tolerances is immediately and clearly visible on the screen of the Comparator.

Inspection with Jones & Lamson Comparators leaves no room for doubt; the evidence is positive, conclusive and clearly visible.

Many components and products formerly inspected by slow tedious methods, that retarded production and drained profits, are now inspected in seconds or minutes on Jones & Lamson Comparators, by operators with only a minimum of instruction. Savings are made all along the line, in gage cost, in time and in overhead.

Our engineers are inspection specialists; their knowledge of holding fixtures, handling methods and suitable Comparator equipment has saved hundreds of thousands of dollars throughout the country. Call, write or wire for their services today.

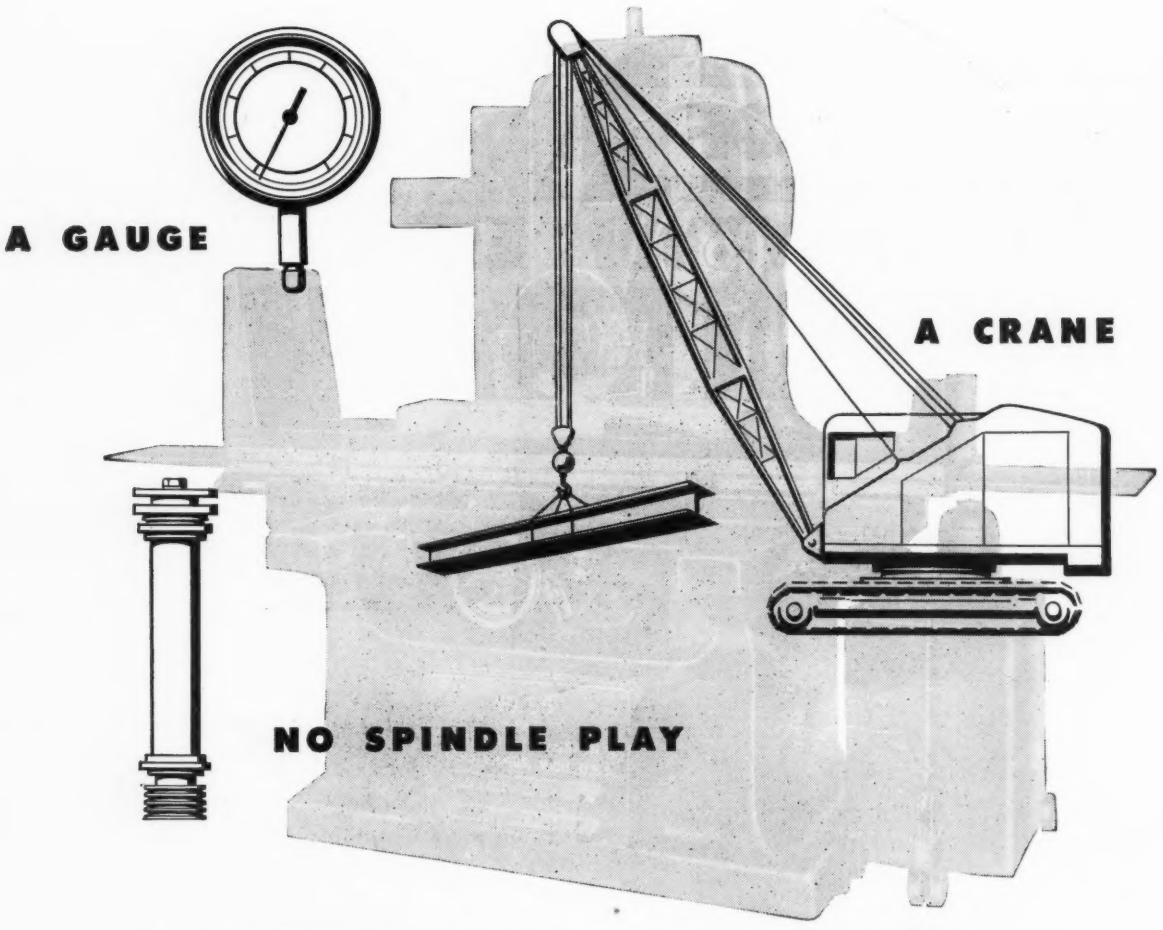
Every owner of a Jones & Lamson Optical Comparator should have this catalog of Standard Glass Screens. Write to Dept. 710 for your copy.



Optical Comparator Division

JONES & LAMSON MACHINE COMPANY
Springfield, Vermont, U.S.A.

MACHINE TOOL CRAFTSMEN SINCE 1835



AND GRAND RAPIDS' MICRO-ACCURACY*

A precision gauge can be only as accurate as the grinding machine used to finish-grind it. The sub-assemblies of a giant crane present an entirely different grinding problem. Whether in removing a few ten thousandths of metal in a high-accuracy operation, or in removing a lot of metal with greater allowable tolerances, freedom from spindle play is extremely important. That's just one of the reasons why you find Grand Rapids Grinders in so many leading plants of all types — from manufacturers of precision gauges to makers of huge cranes. Other assurances of long-life accuracy and speed are: the fastest longitudinal table speed (125 f.p.m.) available in any grinder; vibrationless rigidity achieved by massive one-piece column and base casting; patented vertical head adjustment; Bijur one-shot lubricating system.

*Accuracy within 0.00025 limits.

TO SERVE YOU — *Your inquiry concerning your specific grinding needs will receive prompt attention. Grand Rapids Grinders include: Hydraulic Feed Surface Grinders, Universal Cutter and Tool Grinders, Hand Feed Surface Grinders, Tap Grinders, Drill Grinders, and Combination Tap and Drill Grinders.*

GALLMEYER & LIVINGSTON COMPANY

305 Straight Ave., S.W., Grand Rapids 4, Michigan

GRAND RAPIDS GRINDERS

Analyze the whole Picture...

When you select Cutting Fluids

IN SELECTING cutting fluids for your machining operations consider your choice from every angle. Will it increase production? Will it lower production costs? Will it improve finish? Will it meet all other requirements peculiar to your operation?

When you look at the whole picture you'll want to investigate the advantages to be gained by specifying the dependable, service-proved cutting fluids of Cities Service. Such products, for example, as Cities Service Chillo Oils which have been performance tested in scores of machine shops.

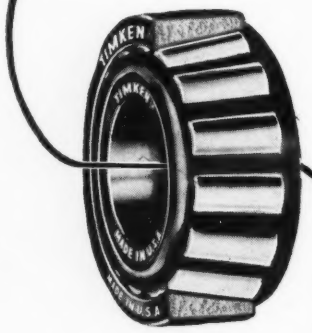
Why not let a Cities Service cutting oil specialist help you select the best type and grade for your purpose? His recommendations may bring you substantial improvements in the quantity and quality of your production.

Free

Write today for our new and informative booklet entitled "Metal Cutting Fluids". Address Cities Service Oil Co., Room 306, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

TIMKEN *Zero precision bearings give* SHELDON *LATHES GREATER ACCURACY*



Because the spindle of the SHELDON TRB-S56 is mounted on Timken Zero Precision Bearings extreme accuracy, higher machining speeds and lower production costs are insured.

Timken Zero Precision Bearings are by far the most accurate tapered roller bearing that can be made in regular commercial production. Runout or eccentricity is restricted to less than .00015 of an inch. Cups and cones of Timken Zero Precision Bearings are matched and shipped as a complete unit.

Due to the line contact between the rolls and races, the spindle is firmly supported—no chance of deflection. Because of the tapered construction and provision for take-up in assembly, there is no possibility of end-movement. Zero Precision Bearings are Timken's very finest, the ultimate result of Timken's 49 years of research and development.

SHELDON TRB-S56

11¼" Swing
1" Collet Capacity
56" Bed
Zero Precision Bearings

SHELDON MACHINE CO. Inc.

Manufacturers of Sheldon Precision Lathes • Milling Machines • Shapers
4246 N. KNOX AVENUE • CHICAGO 41, ILLINOIS, U. S. A.

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NOW AVAILABLE FROM STOCK

Type E
Double-reduction

Type C
Double-reduction

YOU CAN BE SURE..
IF IT'S Westinghouse

Type A
Single-reduction

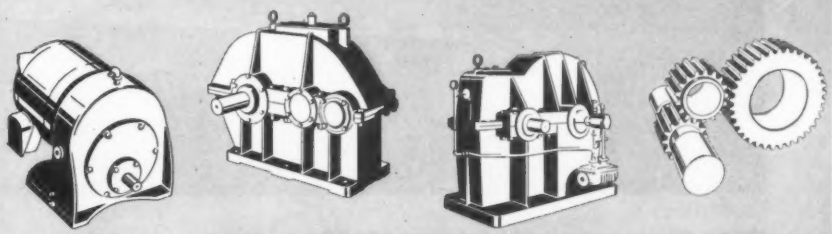
WESTINGHOUSE NOW OFFERS IMMEDIATE DELIVERY ON POPULAR SIZES AND TYPES

Westinghouse Gearmotors are today's best answer for obtaining speed reduction on drive applications from 1 to 75 hp. And now, Westinghouse offers immediate delivery from stock. More than 50 sizes and types are available, comprising commonly used designs, and a few units with special auxiliary features. Many are powered by the revolutionary new Life-Line motor . . . the greatest advance in motor design in 58 years. Call your nearby Westinghouse representative for details on gearmotors available to fit your needs. Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

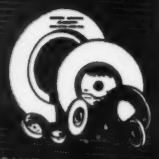
J-07273

Westinghouse

RPM FITTED DRIVES



GEARMOTORS • SPEED REDUCERS • SPEED INCREASERS • INDUSTRIAL GEARING

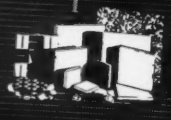


GRINDING WHEELS

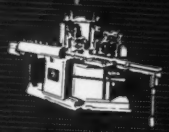
GRINDING MACHINES

REFRACTORIES

NORBIDE



NON-SLIP FLOORS



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NORTON

a continuing symbol of NORTON QUALITY

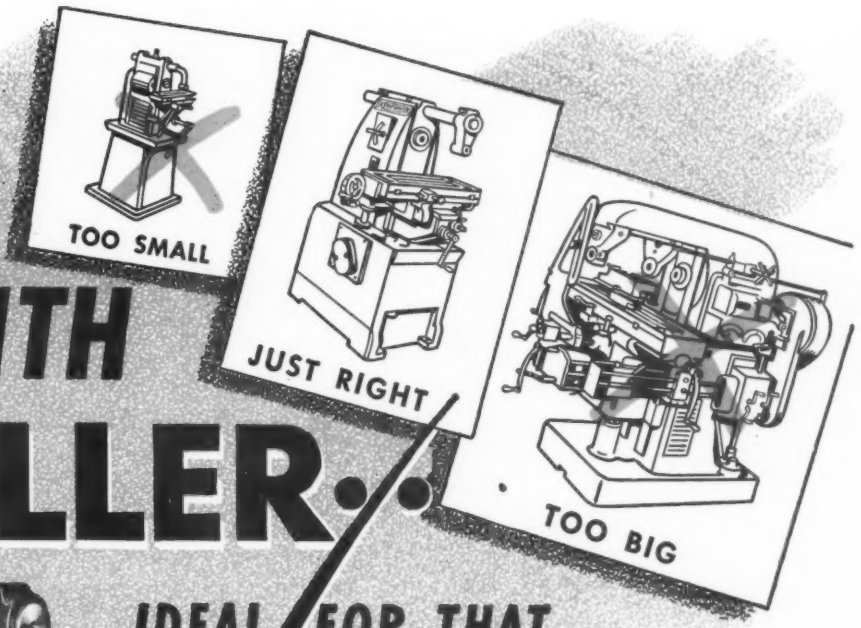
. . . the same wide variety of products . . . backed by the same extensive research . . . backed by the same manufacturing skill in a modernized plant—now marked by a modernized version of the familiar Norton trade-mark.

Every Norton product—from Worcester as well as from the Behr-Manning division at Troy—will bear this symbol of Norton quality.

The main Worcester plant of Norton Company—world's largest producer of abrasive products

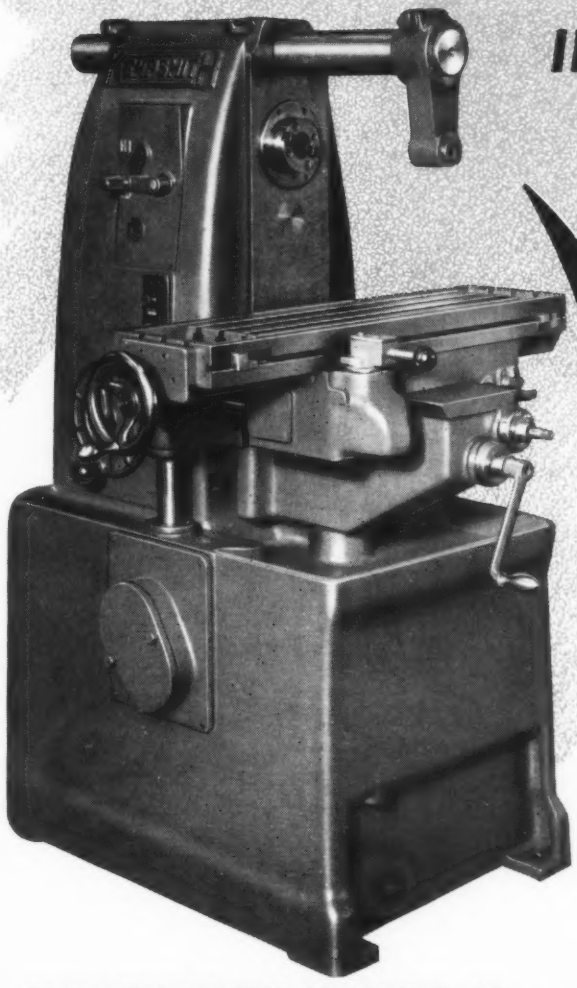
NORTON COMPANY • WORCESTER 6, MASS.

(Behr-Manning, Troy, N. Y. is a Norton Division)



KEMPSMITH LH MILLER

IDEAL FOR THAT "IN BETWEEN" MILLING JOB



Yes — It's a light, horizontal milling machine — but RUGGED and DEPENDABLE like all Kempsmith Millers. Designed primarily to bridge the gap between low range hand millers and big, expensive machines, the LH MILLER combines simple, sound and rigid construction with flexibility and versatility — ideal for small end milling, high speed jig boring, keyways, oil grooving, light straddle milling, etc.

CUTS COSTS IN 3 WAYS — (1) Lowest initial investment and maintenance cost (2) Lowest possible setting up and tearing down time (3) Lowest power consumption. In addition, you are assured of the highest degree of accuracy and rigidity.

Write for Bulletin No. 127

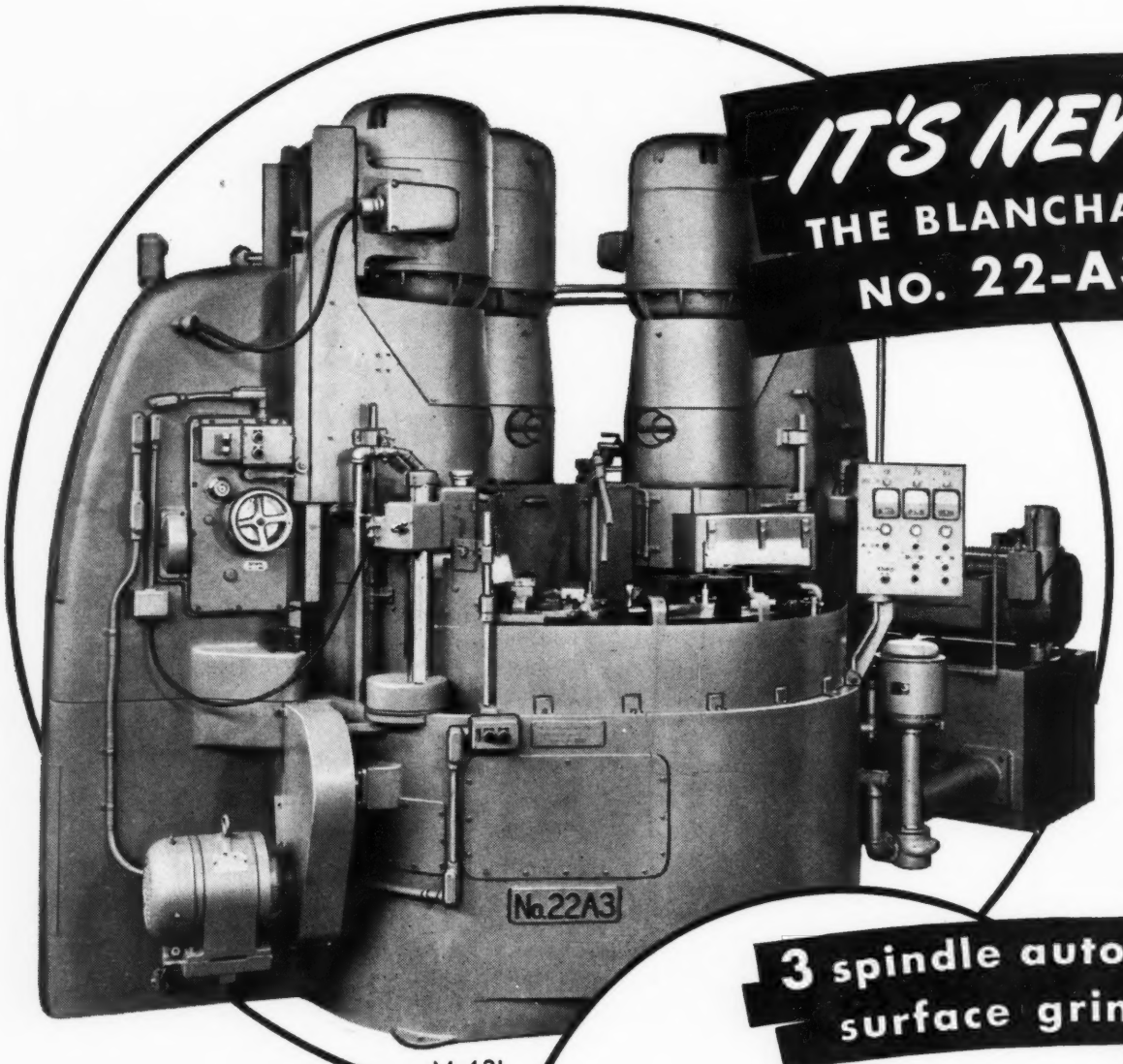
THE KEMPSMITH MACHINE CO., 1821 SOUTH 71st STREET, MILWAUKEE 14, WIS., U. S. A.

KEMPSMITH

• Precision Built Milling Machines Since 1888 •

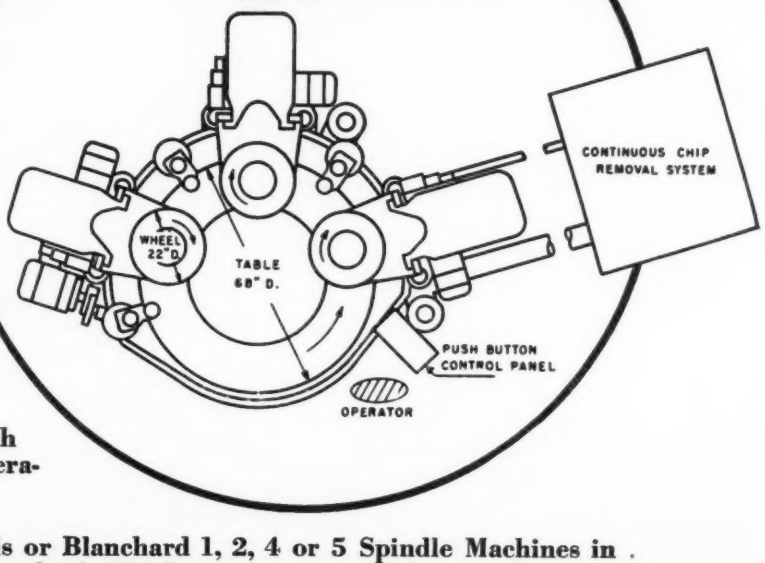
A 5508-1P-C

IT'S NEW... THE BLANCHARD NO. 22-A3



V-431

3 spindle automatic surface grinder



This new Blanchard 22-A3 Surface Grinder is a three spindle machine, completely new in design from the floor up. It permits the grinding of larger work—the removal of more metal — and produces a finer finish than is possible on the Blanchard 16-A series.

The Blanchard 22-A3 may be arranged so that two wheels do roughing and one wheel finishing, or one wheel roughing and two wheels finishing. If a relatively rough finish is satisfactory, all three wheels can take heavy cuts.

For ease of operation complete push button controls are located on the operator's panel.

For complete information on this or Blanchard 1, 2, 4 or 5 Spindle Machines in the new 22-A series with abrasive wheels 22" diameter, rotary tables 68" diameter and larger, write us today. New free catalog will be sent on request.

BLANCHARD

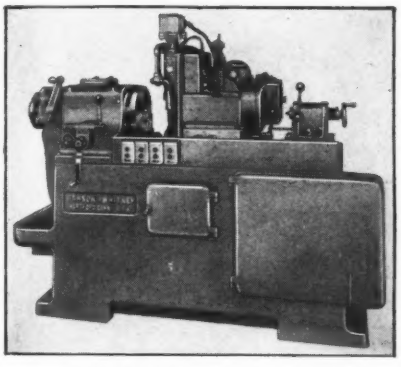
The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

Hanson-Whitney Thread Grinder features Easier . . . Faster . . . More Wheel Dressings

Hanson-Whitney extends an invitation to you to *see* its new semi-automatic Thread Grinder at work. It is impossible, in restricted space, to explain the importance of this engineering achievement . . . to provide the necessary close-up photographs that bring out the many design innovations . . . nor can we show you the accuracy, the speed, the quality of production.

But we *can* arrange an appointment that we believe will interest anyone who needs a



STREAMLINED, COMPACT HANSON-WHITNEY THREAD GRINDER

better, faster method for grinding external threads from the solid on a production basis.

You will see a Master Roll that re-trues the Grinding Wheel for re-grinding the Crusher Roll in position, whenever its pattern has been worn by repeated crushing of the wheel. This means uninterrupted production for a long time . . . until the original Master Roll thread pattern itself becomes worn.

This is but one valuable feature of the new Thread Grinder. There are many more which combine to step up machine performance, lower operator fatigue, reduce rejects, and greatly improve the work.

If you are interested in rapid production thread grinding, we ask you to write us.

1HW49

Maybe

THEY SHOULDN'T BE SO EXPENDABLE

It seems to be a foregone conclusion in many plants that taps in the screw machine sizes are *expected* to break . . . and *expected* to wear out . . . quickly.

Well, there's a big difference in taps and also in the meaning of "quickly."

Here at Hanson-Whitney we know that taps are expendable to a degree . . . but the degree depends upon many factors such as tap selection, type of operation, work material and lubrication.

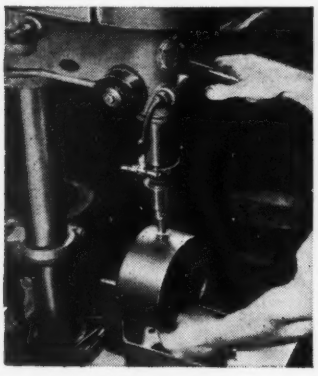
If you are having troubles with tap breakage and tap wear we suggest that you do two things, 1) Write for our engineering suggestions, 2) Specify Hanson-Whitney taps . . . finished after hardening. There are no finer taps made.

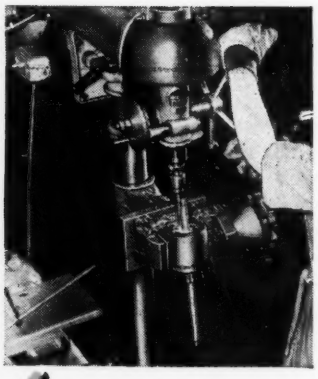
HANSON-WHITNEY MACHINE CO. HARTFORD 2, CONN.
Division of Whitney-Hanson Industries, Inc.

For practical recommendations submit your problems to Hanson-Whitney engineers.

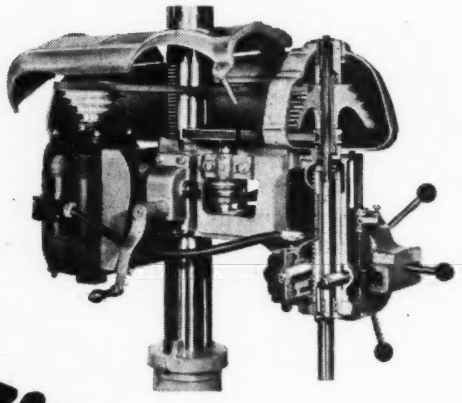
Hanson Whitney

PIONEERS OF FINISHED TAPS





Model D-1101X. Price:
less motor and column $245.25*



FOR EXAMPLE

KINGSTON-CONLEY ELECTRIC CO.

TRIPLES PRODUCTION BY TURNING MOTOR SHAFTS

WITH WALKER-TURNER 20" POWER FEED DRILL HEADS

Demands for increased production on turning motor and grinder shafts at Kingston-Conley Electric Co., North Plainfield, N. J., necessitated replanning production equipment and methods.

Replacing five lathes with five Walker-Turner 20" Power Feed Drill Presses each equipped with a molybdenum high speed box tool containing three separate bits held with set screws and a Jacobs Chuck on each spindle, *three shaft diameters are now turned in a single operation.* Power feed controls on Drill Heads feed the work into box tools at .003" to .009" per spindle revolution. Accuracy is kept at .004" tolerance.

Results: **production tripled; man-hour costs halved.**

Taking further advantage of the broad adaptability of Walker-Turner Machine Tools, Kingston-Conley has set up 15" and 20" Drill Heads with similar ingenuity in other departments of the plant. Increases in production and job efficiency have been equally outstanding.

Variable speeds and methods of mounting and control, plus the ability to work metals, plastics or wood, are the marks of all low-cost Walker-Turner Machine Tools. *For complete catalog, write to Walker-Turner Division, Kearney & Trecker Corporation, Plainfield, New Jersey.*

Photo, right: Turning motor shafts on standard 20" Power Feed Drill Presses.

Photo, upper left: Spinning insulation fibre bushings over steel motor bands with 15" Drill Press.

Photo, center above: Balancing motor rotors with 15" Drill Press. Depth Gauge Indicator shows amount of metal to be removed for correct dynamic balance.

Photo, upper right:* 20" Power Feed Drill Head, Model D-1101X. 4 ball bearings, 6" spindle travel. Five standard spindle speeds, 400 to 2600 r.p.m. with 1740 r.p.m. motor. Capacity 1" in cast iron, ¾" in steel. Slo-speed motor optional.

walker-turner **MACHINE TOOLS**

DRILL PRESSES—HAND AND POWER FEED
RADIAL DRILLS • RADIAL SAWS
BAND SAWS—FOR WOOD OR METAL
RADIAL METAL CUT-OFF MACHINES • MOTORS

SOLD ONLY
BY AUTHORIZED
INDUSTRIAL MACHINERY
DISTRIBUTORS

3465

A-H5

(5 PCT CHROME AIR-HARDENING)

A-H5 combines the safety of air-hardening with excellent resistance to distortion. It is deep-hardening in large sections and has high resistance to shock and wear. Shown is a ring gauge made of A-H5.

An air-hardening tool steel *that's easy to machine*

Air-hardening tool steels are the best choice for many tools and dies, but the more highly-alloyed of these grades often present machining problems. Toolmakers like A-H5 because this lower-alloy type is annealed to 212 Brinell or less for easy-machining, yet provides the great safety of air-hardening.

A-H5 is recommended for the same tool and die jobs where you are using the standard oil-hardening tool steels such as BTR (Bethlehem Tool Room). A-H5 is of course the choice when a relatively drastic quench in oil is not permissible. And it is preferred when you need deeper hardening, greater resistance to distortion, and higher wear-resistance for cutting edges.

Use A-H5 for dies, punches, blanking tools, cold-forming dies, master tools and the like. Give it a thorough trial and you'll agree that it belongs in your tool room. The nearest Bethlehem sales office or tool steel distributor will gladly give you full details and arrange for prompt delivery.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

QUICK FACTS ABOUT A-H5

	C	Mn	Cr	Mo	V
Typical Analysis:	1.00	0.60	5.25	1.10	0.25

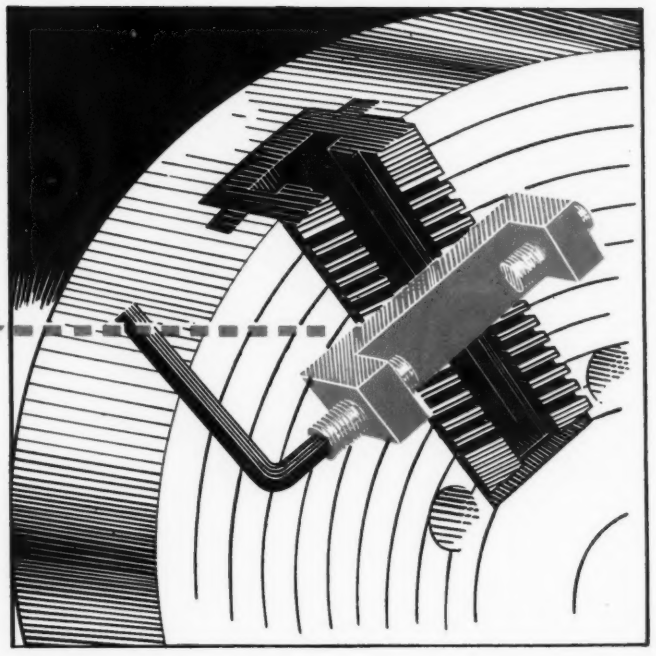
Annealing: Pack, heat to 1650 F, slow furnace-cool, Brinell 212 max
Preheating: 1200 to 1250 F, prior to hardening
Hardening: 1775 F, air-quench
Tempering: 350 to 400 F, Rockwell C 60 to 62

BETHLEHEM STEEL

A-H5 ...one of Bethlehem's fine tool steels

Safety margins... *plus*

for *heavy*
Carbide Tool
Cutting

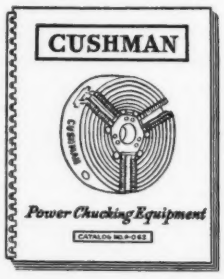


CUSHMAN *Power* CHUCKS

Coarse feeds and high speeds with Carbide Tools place a heavy burden on modern machine tools . . . full output potentials cannot be achieved without work-holding equipment designed to carry the load.

Cushman Power Chucks meet this need . . . with a plus margin of safety . . . in precision centering, positive controlled grip, greater output, minimum rejects. They relieve the operator of the burden of manual operation in repetitive production . . . a twist of the wrist or a touch of the toe . . . and jaws grip or release work instantly. Cushman's exclusive "Accralock" feature permits fast, individual jaw adjustment to within .001" concentricity and maintains that accuracy indefinitely. A Cushman installation, easily made on present equipment, is a definite attack against present fixed high costs . . . gives you a competitive advantage in production.

Write for **CATALOG PO63**



THE CUSHMAN CHUCK COMPANY
Hartford 2, Connecticut

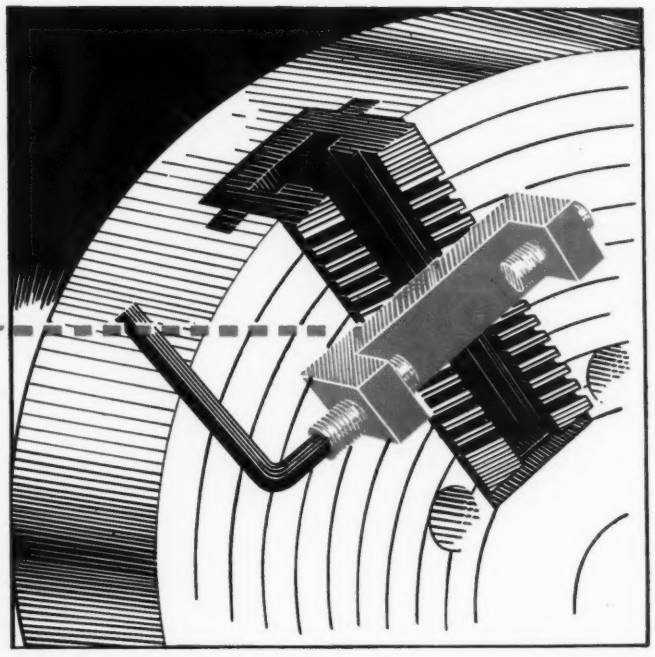
CUSHMAN also manufactures
a complete series of
WRENCH OPERATED CHUCKS
Write for Catalog 63 and Bulletins

Consult
CUSHMAN
Chucking Engineers Since 1862

1C549

Safety margins... *plus*

for *heavy*
Carbide Tool
Cutting



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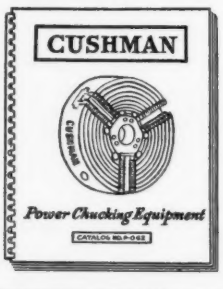

THE CUSHMAN CHUCK COMPANY
Hartford 2, Connecticut

CUSHMAN also manufactures
a complete series of
WRENCH OPERATED CHUCKS
Write for Catalog 63 and Bulletins

Consult
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Chucking Engineers Since 1862

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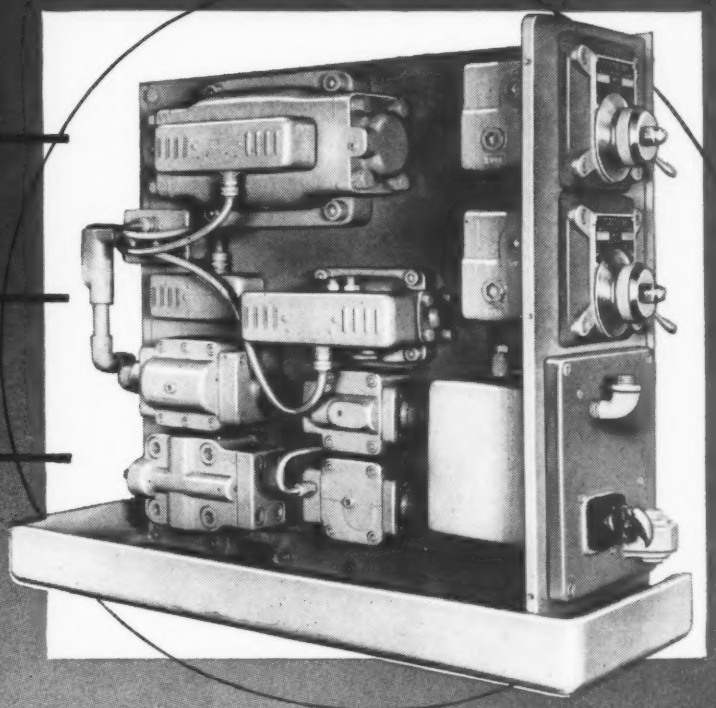
VICKERS Gasket Mounted Hydraulic CONTROL VALVES

Simplify Installation

Save Space

Make Adjustment Easier



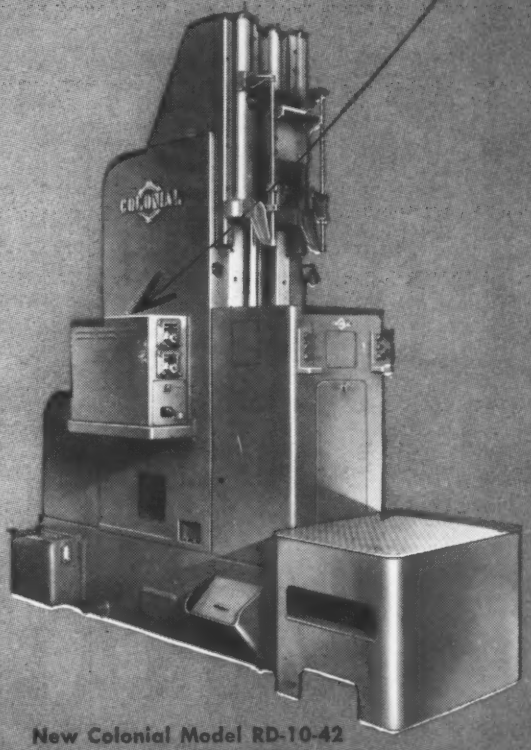
This new Colonial Pull-Down Broaching Machine is an excellent example of how Vickers Gasket Mounted Valves simplify installation, save space and make adjustment easier for hydraulic control systems.

All valves in the panel box are easily accessible for adjustment by simply removing the cover. For cleaning and other maintenance, any valve can be completely removed by just loosening the hold-down screws . . . the piping is not disturbed and the system is not drained. The installation is simplified and more compact because all hydraulic piping connections are made into the opposite side of the machined surface upon which the valves are mounted with sealing ring type gaskets. The concealed piping also results in improved appearance.

Contact the Vickers Application Engineering Office nearest you for suggestions on how Vickers Hydraulic Equipment can improve your machinery.

All hydraulic control units for the machine are included in this group. Flow control valve adjustments convenient to operator without opening panel box.

WRITE FOR NEW BULLETIN, 48-27
This bulletin will give you useful information regarding applications, advantages and installation drawings for Vickers Gasket Mounted Solenoid Controlled Directional Valves.



New Colonial Model RD-10-42 Pull-Down Broaching Machine has Vickers Hydraulic Controls.

VICKERS Incorporated
DIVISION OF THE SPERRY CORPORATION
1403 OAKMAN BLVD. • DETROIT 32, MICHIGAN
Application Engineering Offices: ATLANTA • CHICAGO • CINCINNATI • CLEVELAND • DETROIT
LOS ANGELES • NEWARK • PHILADELPHIA • PITTSBURGH • ROCHESTER • ROCKFORD
ST. LOUIS • SEATTLE • TULSA • WASHINGTON • WORCESTER

Announcing

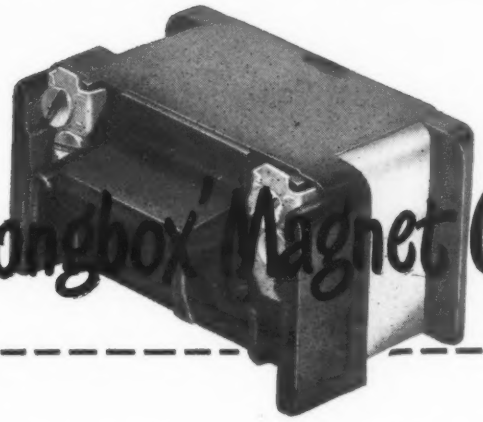
NEMA Sizes 0, 1, 2, 3
for a-c motors up to 50 hp

GENERAL ELECTRIC

a complete NEW line

MOTOR STARTERS

with the



'Strongbox' Magnet Coil

all new all the way thru

Here it is—a completely new line of G-E motor starters—full-voltage starters made for extra-long life, faster installation. Designed for easy maintenance, but built so you can forget them.

NEMA Sizes 0, 1, 2, and 3—each size new all the way through. Everything's new—contacts, arc hood, magnet, armature, and the tough Strongbox magnet coil. Get your first G-E starter and compare!

SO NEW
SO DIFFERENT
YOU CAN'T AFFORD TO WAIT

ORDER TODAY!

General Electric Company
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Schenectady 5, N. Y.

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GEA-5153 (CR7006 A-c Magnetic S

GEA-5156 (CR7008 A-c Combinatio

Name_____

Company_____

Address_____

Performance Records Prove GREATER PRODUCTION..

New Low Pressure Hydraulic System

● The *smoother, cooler and more quiet operation* of the Lapointe—**Double Ram Variable Speed Hydraulic Surface Broaching Machine**—The D R V, has raised production standards on this type of machine thanks to the new low pressure hydraulic system which *eliminates high pressure shock and machine vibration.*

See the new standard double tip-down fixture with its easy loading and high speed operation that makes *continuous* semi-automatic cycling. Several operation stations can be set on each fixture.

Investigate today the new line of Lapointe broaching machines. *Write for folder #161.*

HUDSON LAPOINTE MASS.

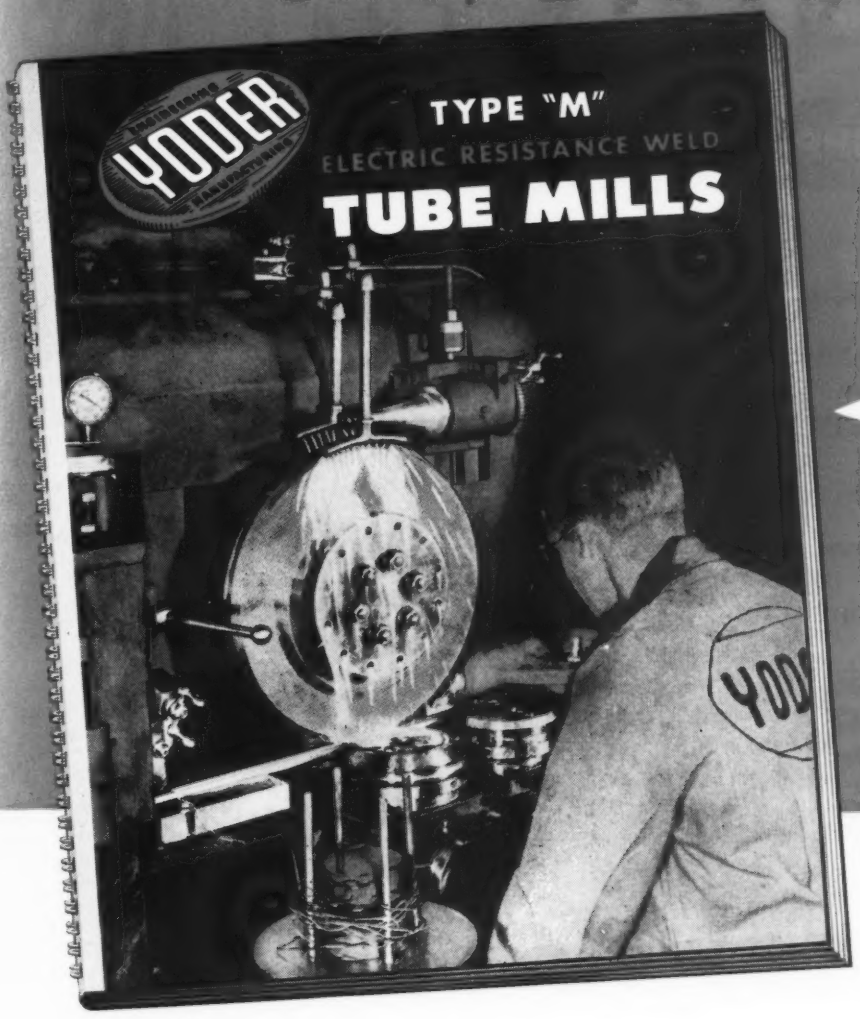
THE Lapointe

MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U. S. A.

Branch Factory • Edgware • Middlesex • England

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES



A 64-page book on the mechanical advantages and commercial possibilities of resistance-weld pipe and tube mills—sent on request.

This Book Answers Many Questions

...about pipe and tube making costs, power consumption, maintenance, production, labor, skill, weld-strength and physical properties, end uses, etc.

It is of special interest to large users of pipe and tubing as well as to primary metal producers and manufacturers considering expansion of their facilities to satisfy the greatly increased and insistently growing demand for pipe and tubing. Copy on request.

THE YODER COMPANY, 5504 Walworth Ave. • Cleveland, Ohio, U.S.A.

ENGINEERING YODER TRADE MARK MANUFACTURING

ROLL FORMING, TUBE MILL AND SLITTING MACHINERY

36 YEARS' LEADERSHIP • COILING • SLITTING • FORMING • EMBOSSING • CURVING • WELDING • CUTTING-OFF

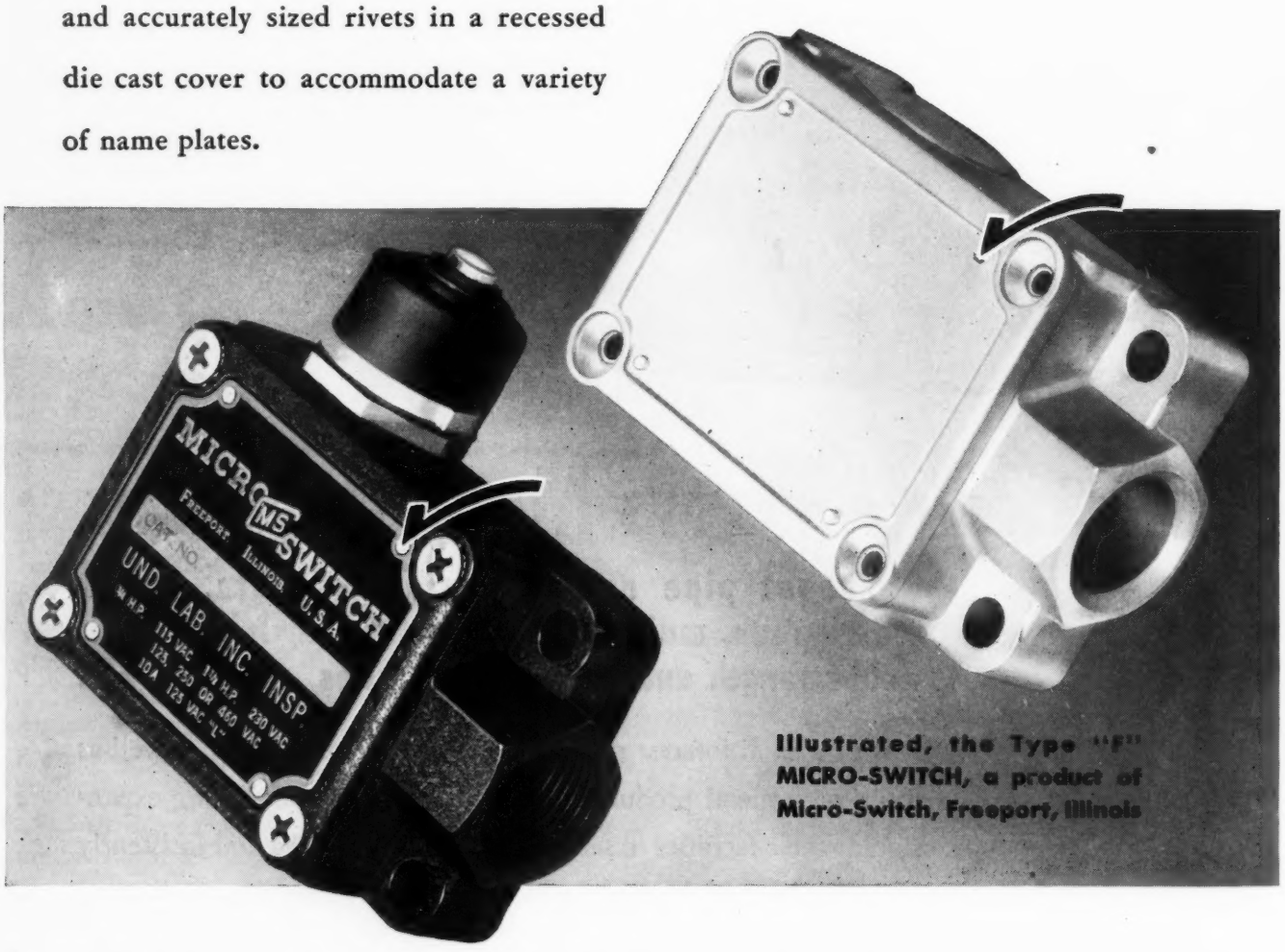
DESIGN IDEAS THAT PAY

in MADISON-KIPP *aluminum die castings*

MICRO SWITCH designers, committed by tradition to highest quality material, required a sturdy interchangeable name plates design.

Madison Kipp casts four accurately spaced and accurately sized rivets in a recessed die cast cover to accommodate a variety of name plates.

Engineers and designers often find helpful cooperation by Madison Kipp craftsmen whose life work has been the practical application of die castings to new uses.



Illustrated, the Type "F" MICRO-SWITCH, a product of Micro-Switch, Freeport, Illinois

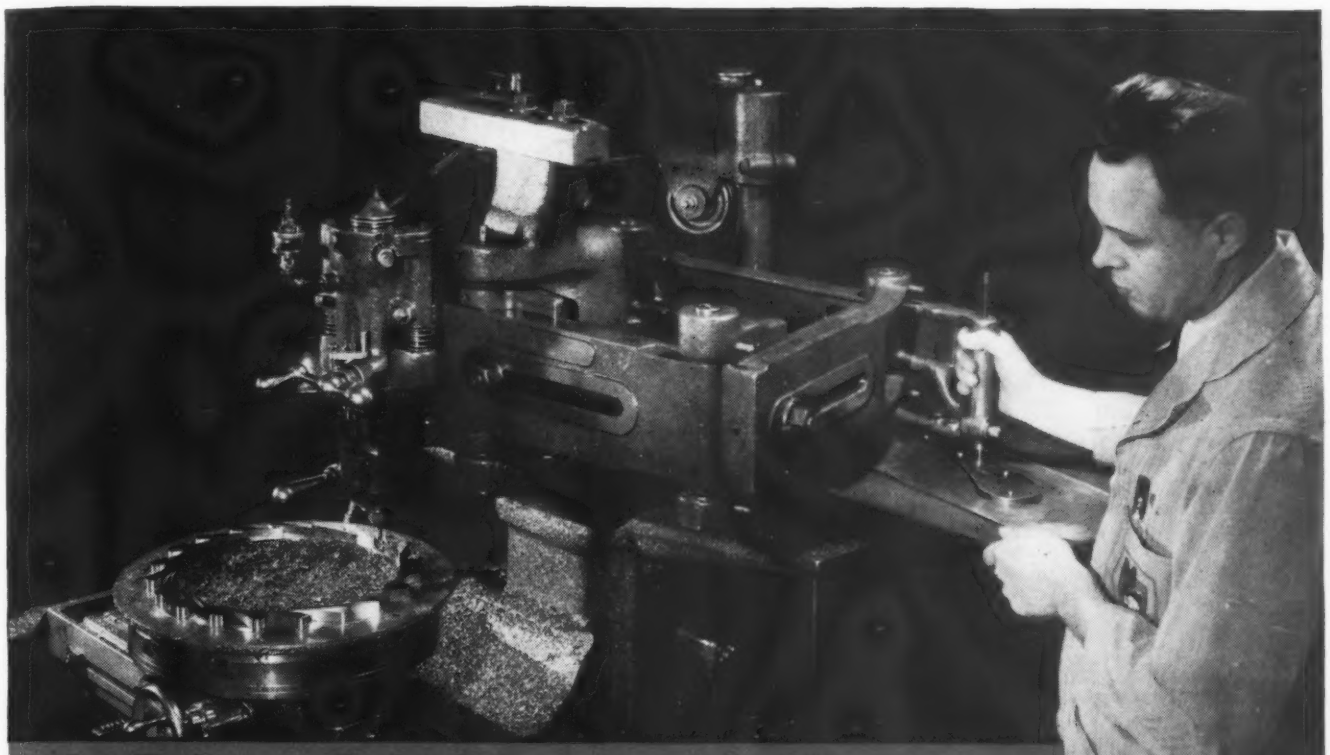
MADISON-KIPP CORPORATION

203 Waubesa Street, Madison 10, Wis., U.S.A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marias, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand

- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really High Speed* AIR TOOLS



A 5-Day Job Done in 10 Hours!

PROFILE MILLING STAINLESS STEEL with GORTON and Tracer Control!

This experimental short run job was done on a Gorton *Profiling Pantograph* with a simple, over-size master and tracer control for the Elliott Company of Jeannette, Pa. Completely automatic tooling for a production run would save an additional 6 hours. Compare this with any other method.

This is just one example of cost saving made possible with Gorton Tracer Controlled Equipment which includes die and mold duplicators, pantograph machines, super-speed vertical mills and plain type horizontal mills. Gorton features high spindle speeds, wide versatility and high precision.

Ask for Production Estimate . . .

We will be glad to furnish a production estimate on your work — send us complete description with prints — no obligation.

THE JOB IN BRIEF

MATERIAL — Stainless Steel

OPERATION — Profile 20 turbine blades 15" deep from the solid in a circle 13.135" outside diameter.

FIXTURES — Gorton Rotary Table and 5 times-size master cut from sheet iron.

CUTTERS — 2 carbide 2-flute and 2 H.S. Steel 4-flute.

TIME — 10 hours. Finish better than 30 micro inches. Time Saving over any other method 40 hours or better.

REMARKS — Tooled for Automatic high production work, the time would be cut to 4 hours.

SEND FOR BULLETIN 1655 today! This provides information on all Gorton tracer-controlled machines.

GEORGE GORTON MACHINE CO.

Tracer Controlled Milling

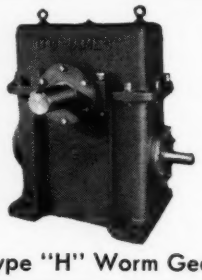
1302 RACINE STREET, RACINE, WISCONSIN, U. S. A.

D.O.James

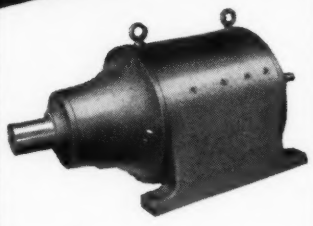
ESTABLISHED 1888

GEARED DRIVES MEET GROWING DEMANDS FOR POWER-SAVING EQUIPMENT IN INDUSTRY

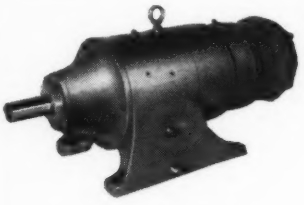
Continuous-tooth Herringbone
Single, Double, Triple Reduction



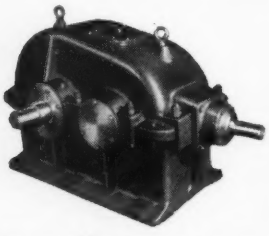
Type "H" Worm Gear



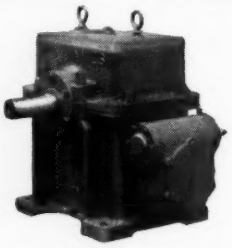
Straight Line Gear Reducer



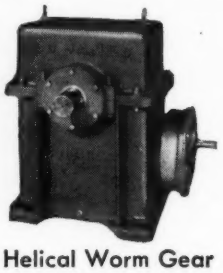
Motorized Reducers



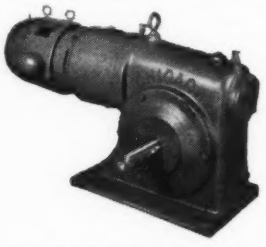
Spiral Bevel Herringbone



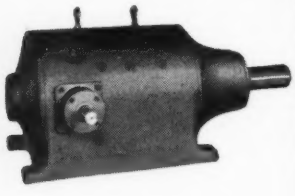
Double Worm Gear



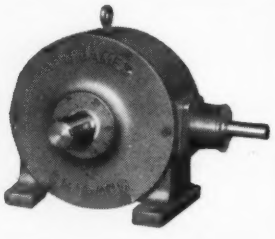
Helical Worm Gear



Motorized Worm Gear



Right Angle Gear Reducer



Spiral Bevel Gear

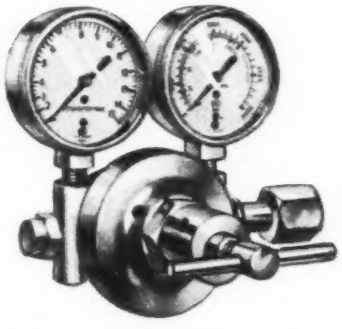
D.O.James Gear Manufacturing Co. is constantly developing and continuing to improve its variety of gear speed reducers—enabling engineers and designers of power-saving equipment to meet and cope with space limitations, horsepower requirements, ratios, location of driven or driving shafts and the type of drive that the many and varied installations require. Catalogs are available containing complete informative engineering data that will assist in the selection of the type of reducer for the specific job to be done.

D.O.JAMES GEAR MANUFACTURING CO.

Since 1888—Makers of Cut Gears, Gear Reducers and Flexible Couplings

1140 W. MONROE STREET • CHICAGO, U. S. A.

Take a good look at a 22% saving



Double Gauge Oxygen Welding and Cutting Regulator, made by John Nageldinger & Son, Inc., New York, "Manufacturers of apparatus for the regulating and control of compressed gases since 1880." The cutaway illustration of the regulator is full-scale. All seals in the body are metal-to-metal, no gaskets being used. All parts, excepting the steel spring and nylon valve seat, are copper and copper alloys made by The American Brass Company.

HIGH GAS PRESSURES and sand castings just don't get along together. In fact, when test stand rejects on this job ran as high as 30% at several thousand pounds pressure, something had to be done about it . . . for not only the castings, but all machining operations were a total loss.

The manufacturer consulted The American Brass Company. Dies were made with a few slight changes in design and Anaconda Die Pressed Forgings, made of extruded rod, were supplied as illustrated here and on the following page.

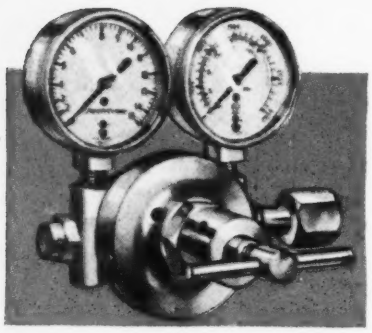
Good news followed quickly: "Leakers" became a thing of the past, for these twice-wrought, dense-grained forgings are gas, air and water-tight. Rejects during machining dropped from an average of 18% to less than 1%. Combined tooling and machining costs were cut in half!

In this instance, the switch to Anaconda Die Pressed Forgings resulted in a net saving of 22%—with rejects and costs *down* . . . dependability and profits *up*.

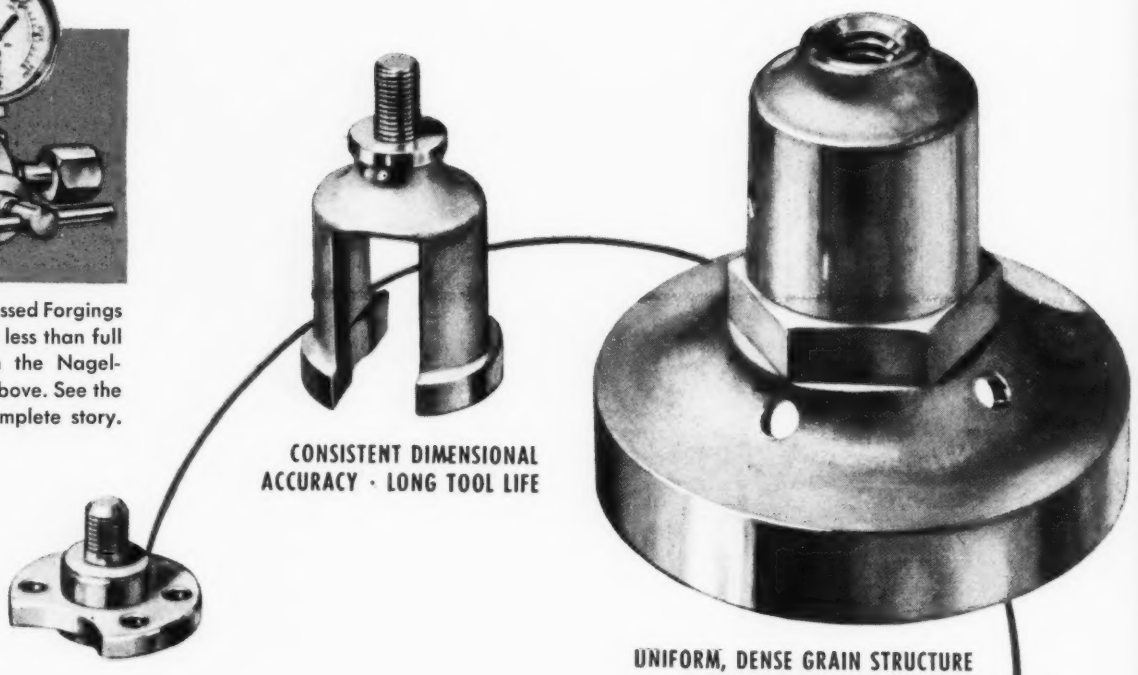
ANACONDA
from mine to consumer

THE AMERICAN BRASS COMPANY, General Offices: Waterbury 88, Connecticut

Perhaps similar savings could be made on your product . . .



The five Anaconda Die Pressed Forgings illustrated here in slightly less than full scale are being used in the Nageldinger Regulator shown above. See the previous page for the complete story.



CONSISTENT DIMENSIONAL ACCURACY · LONG TOOL LIFE

UNIFORM, DENSE GRAIN STRUCTURE GAS, AIR AND WATER-TIGHT

SMOOTH TEXTURE— LOWER FINISHING COSTS

Don't be misled by their good looks!

Of course they're handsome, but make no mistake—these die pressed forgings are huskies throughout... solid, dense-grained working metal, with twice the strength of ordinary sand castings.

They're easy to machine, too—and more uniform than peas in a pod. Often it's simply a matter of drilling and tapping a few holes, threading a boss, or machining a mating fit—and they're ready for assembly.

If the production of unusual shapes is taking too big a bite out of your profits, send us a drawing, pattern or sample part, together with functional data. There's a very good chance that we'll be able to help you... we've done it hundreds of times for others. For general information on Anaconda Die Pressed Forgings, write for Publication B-9.

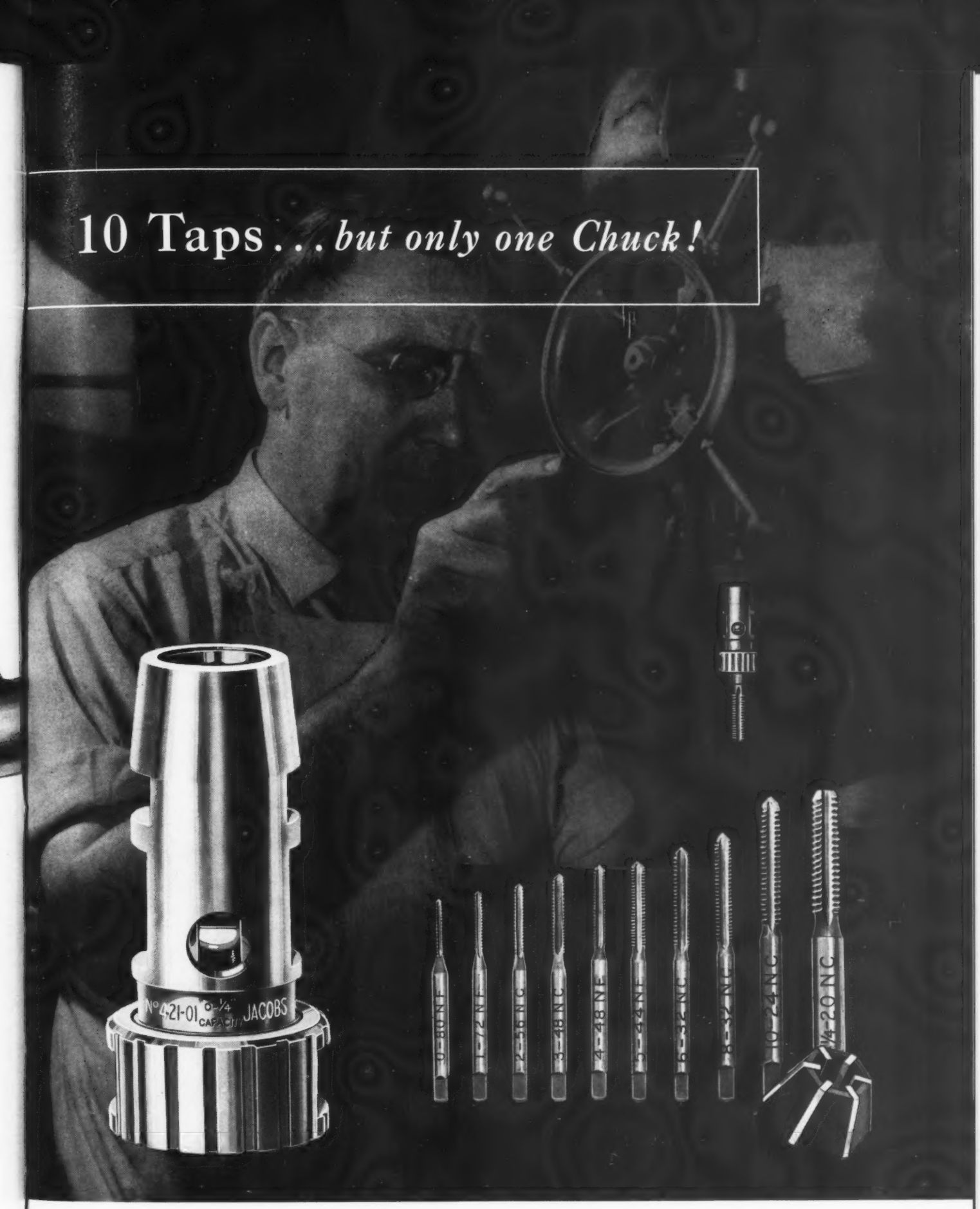
48122

THE AMERICAN BRASS COMPANY
General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

Anaconda
DIE PRESSED FORGINGS

AVAILABLE IN COPPER, BRASS, BRONZE AND SPECIAL COPPER ALLOYS

10 Taps . . . *but only one Chuck!*



Collet changing is a thing of the past when a Jacobs Rubber-Flex Tap Chuck holds the tool. *One chuck takes all the taps in its range without the necessity of changing sleeves or collets!* The Jacobs No. 421-01 Tap Chuck, for example, has a capacity from #0 machine screw taps to ¼" hand taps.

Light in weight and small in diameter, Jacobs Tap Chucks are designed to keep spindle inertia to a minimum. Rugged floating back jaws provide a sturdy positive drive. The Rubber-Flex Collet with its parallel bite provides the centralizing mechanism assuring extreme accuracy. External dimensions are ground and the internal bearing surfaces are precision bored. And tap changing is simplified—a quarter turn of the cap and the jaw screw disengages the tap from the chuck.

Stocked by your Industrial Supply Distributor. The Jacobs Manufacturing Co., Hartford 2, Conn.

If it's a JACOBS, it holds

FOREMOST IN CHUCKS · FIRMEST IN GRIP

Jacobs Chucks

Tilting Wheelhead on T-P 6" Rotary Surface Grinder
Fine-pitch Adjustment on Movable Spindle
T-P CompAIRator Air Gage
Pivoted Arm
Air Nozzle
Special Splash Guard

T-P Gaging Accessory Multiplies Production on Taft-Peirce 6" Rotary Surface Grinder

With this new accessory, the operator of a Taft-Peirce 6" Rotary Surface Grinder can accurately gage—as he grinds—the amount of stock that has been removed from the work face. *Removal of the work for hand gaging is completely eliminated.* Production is doubled, even tripled, and spoilage drastically reduced.

Before starting a production run, a master setting gage is used to set the nozzle and dial pointer of a specially equipped Taft-Peirce CompAIRator Air Gage. From then on the nozzle arm is merely swung over the work surface, as each new piece is inserted, and adjusted to the selected dial reading. While grinding, the operator merely watches the pointer until it indicates that the required amount of stock has been removed. *Coolant flow does not affect gaging accuracy.*

The T-P CompAIRator Air Gage can be applied to other machine tools, too. And on the inspection bench, it is the ideal air gage for precision checking.

For additional information about this unusual gage and accessory, write to:

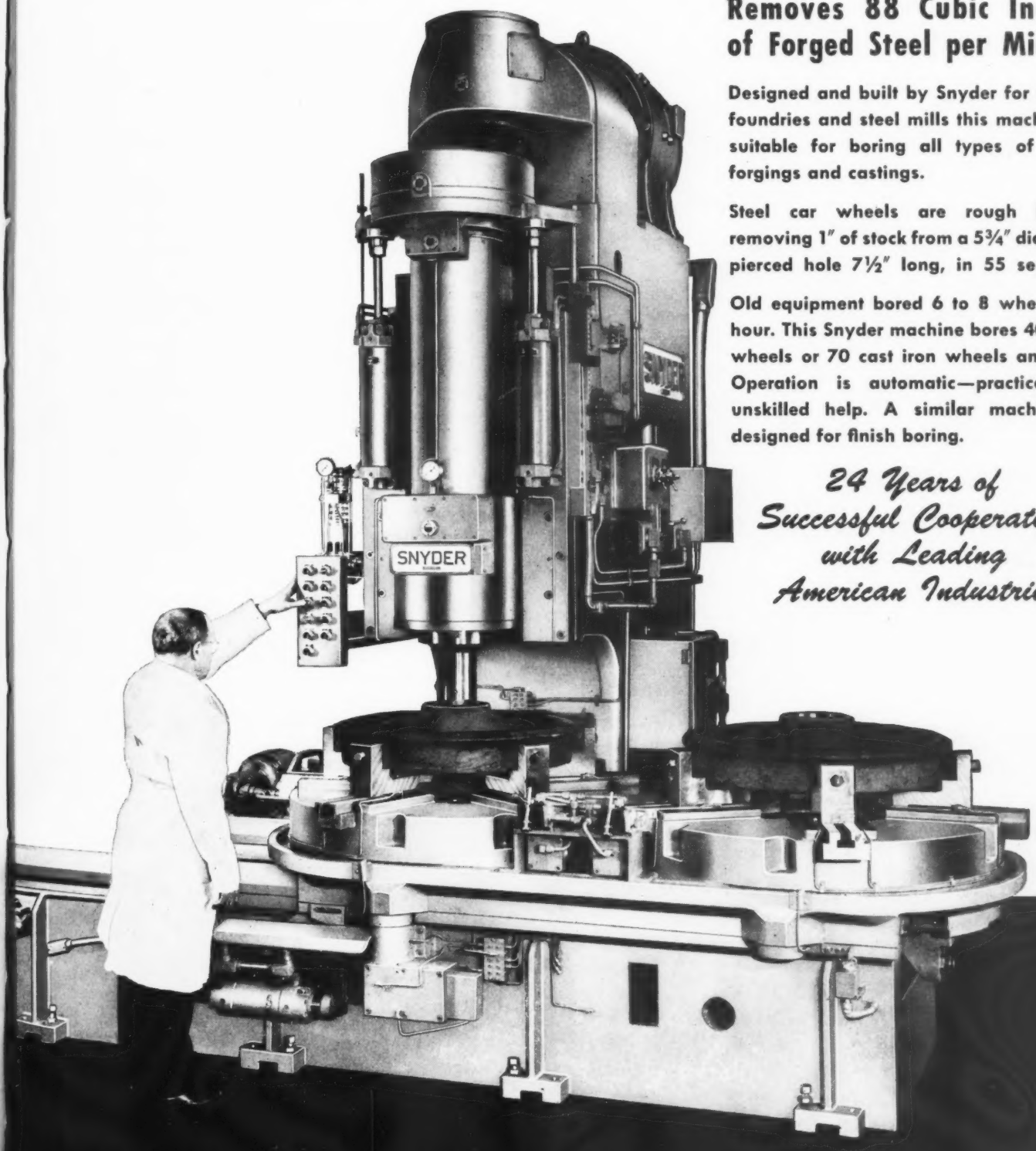
THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

T-P *means* TOP PRECISION

For hard-to-grind-jobs this versatile 6" Rotary Surface Grinder has a flexibility that practically eliminates complex set-ups. Work spindle swivels 7½°; *exclusive Tilting Wheelhead* swivels from horizontal to 30° below wheel center. Write for circular.

SNYDER

MACHINE FOR BORING BIG FORGINGS



Removes 88 Cubic Inches of Forged Steel per Minute

Designed and built by Snyder for use in foundries and steel mills this machine is suitable for boring all types of large forgings and castings.

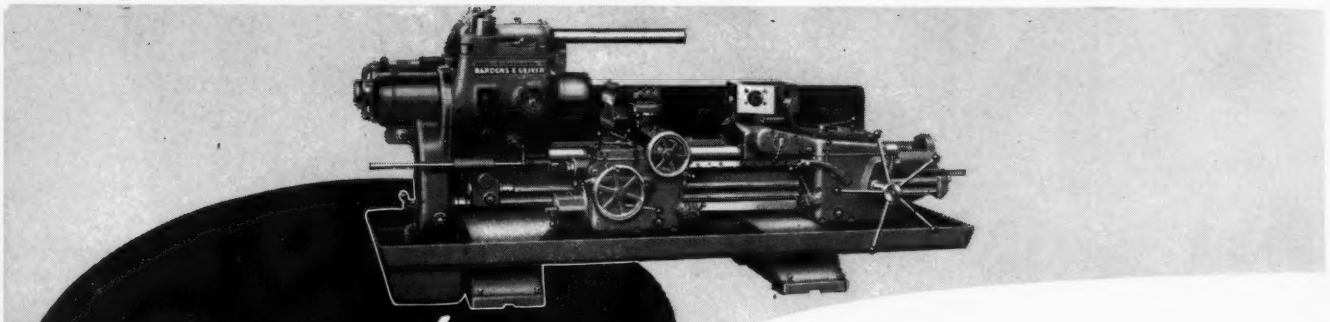
Steel car wheels are rough bored, removing 1" of stock from a 5¾" diameter pierced hole 7½" long, in 55 seconds.

Old equipment bored 6 to 8 wheels an hour. This Snyder machine bores 40 steel wheels or 70 cast iron wheels an hour. Operation is automatic—practical for unskilled help. A similar machine is designed for finish boring.

24 Years of Successful Cooperation with Leading American Industries

SNYDER TOOL & ENGINEERING CO.

3400 E. LAFAYETTE, DETROIT 7, MICHIGAN



Outstanding Ease of Control..

MEANS GREATER PRODUCTION from the Bardons & Oliver No. 21 Saddle Type Turret Lathe

Any speed change can be made hydraulically in an average time of two seconds. The spindle speed is preselective. Power traverse to turret saddle and cross slide carriage is easy to control and saves operating time. The hydraulic collet chuck has ample power for heaviest feeds, and combined with the hydraulic bar feed, reduces operating effort while saving time.

These and many more time and labor saving features combine to make THE NO. 21 SADDLE TYPE TURRET LATHE outstanding for both bar and chucking work.

A blue print or sample of your work will permit our engineers to offer their recommendations.

Builders of a complete line of Ram and Saddle Type Turret Lathes, also Hydraelectric, Hydraulic and Hand Operated Cut-Off Machines

BARDONS & OLIVER, INC.

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NIAGARA

Presents America's Newest and Finest

16 GAGE FOOT SHEAR

Featuring

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- Welded steel strength and rigidity
- Formed steel throughout
- Automatic holddown
- Heavy duty bronze ways
- Clean straight cuts
- Easy operation — lively action
- Portable
- 30, 36 and 42" cutting lengths

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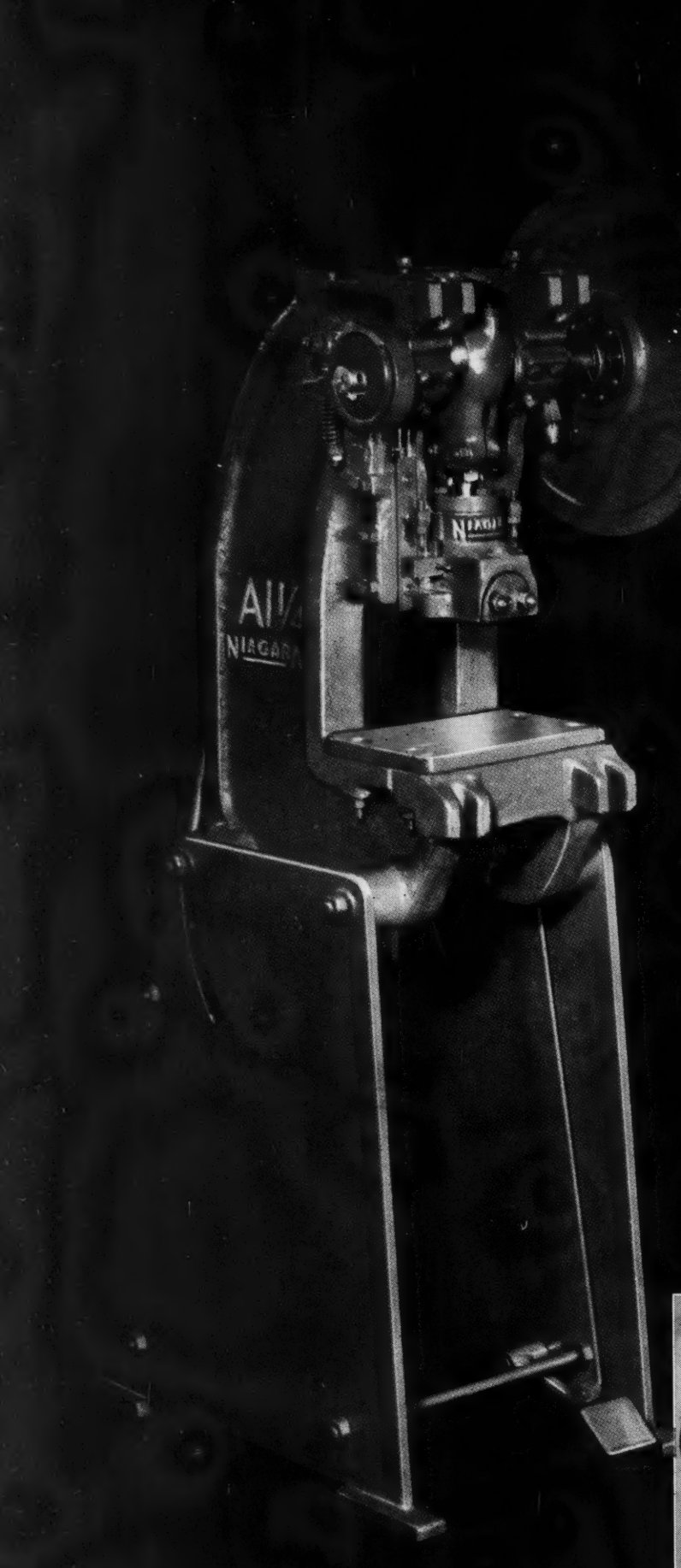
DISTRICT OFFICES: NEW YORK, CLEVELAND, DETROIT



ONLY N

SM

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● You get the same advanced design in small Niagara Inclinable Presses as you get in the largest sizes. Don't overlook the importance of this because small presses run as much as 6½ times as fast as large presses. Regardless of size you get quality when you get Niagara Inclinable Presses.

Instant Engagement of the Sleeve Clutch as compared with the slower action of other mechanical press clutches produces more work strokes per hour.

Multiple "V" gibs provide more guiding surface which minimizes wear, maintains alignment of slide with bed and and thus increases die life.

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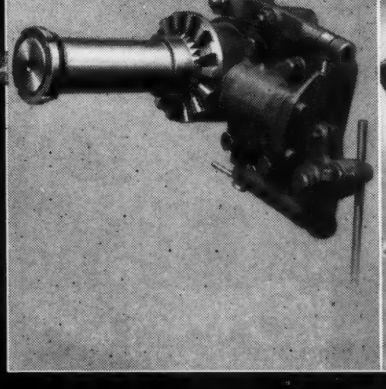
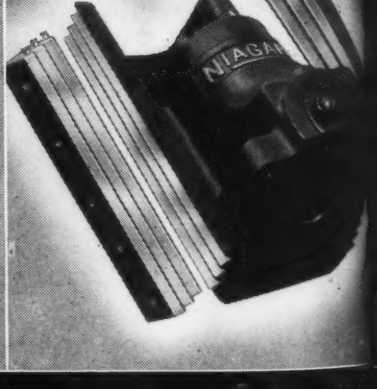




NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y. DI

NIAGARA

SMALL INCLINABLE PRESSES

Give you all these

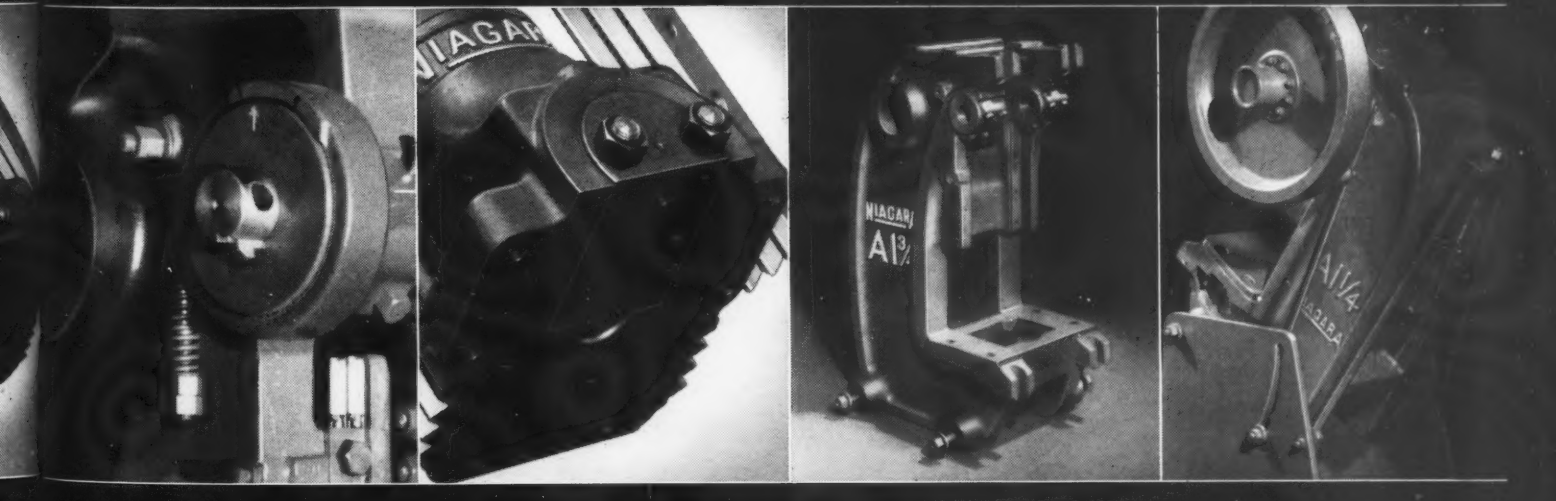
BIG PRESS FEATURES

Brake automatically compensates for wear as well as expansion due to heat of operation. Drum and band marked to indicate correct adjustment.

Slide designed to assure solid backing for die from center to front as well as rear. Breech block die clamp gives solid backing to punch shoe.

Frame designed to provide solid gib mountings . . . strength at the crankshaft bearings and a rigid gap maintaining close alignment of punch and die.

Inclining mechanism easily operated by one man. Working height is not materially changed when press is inclined.



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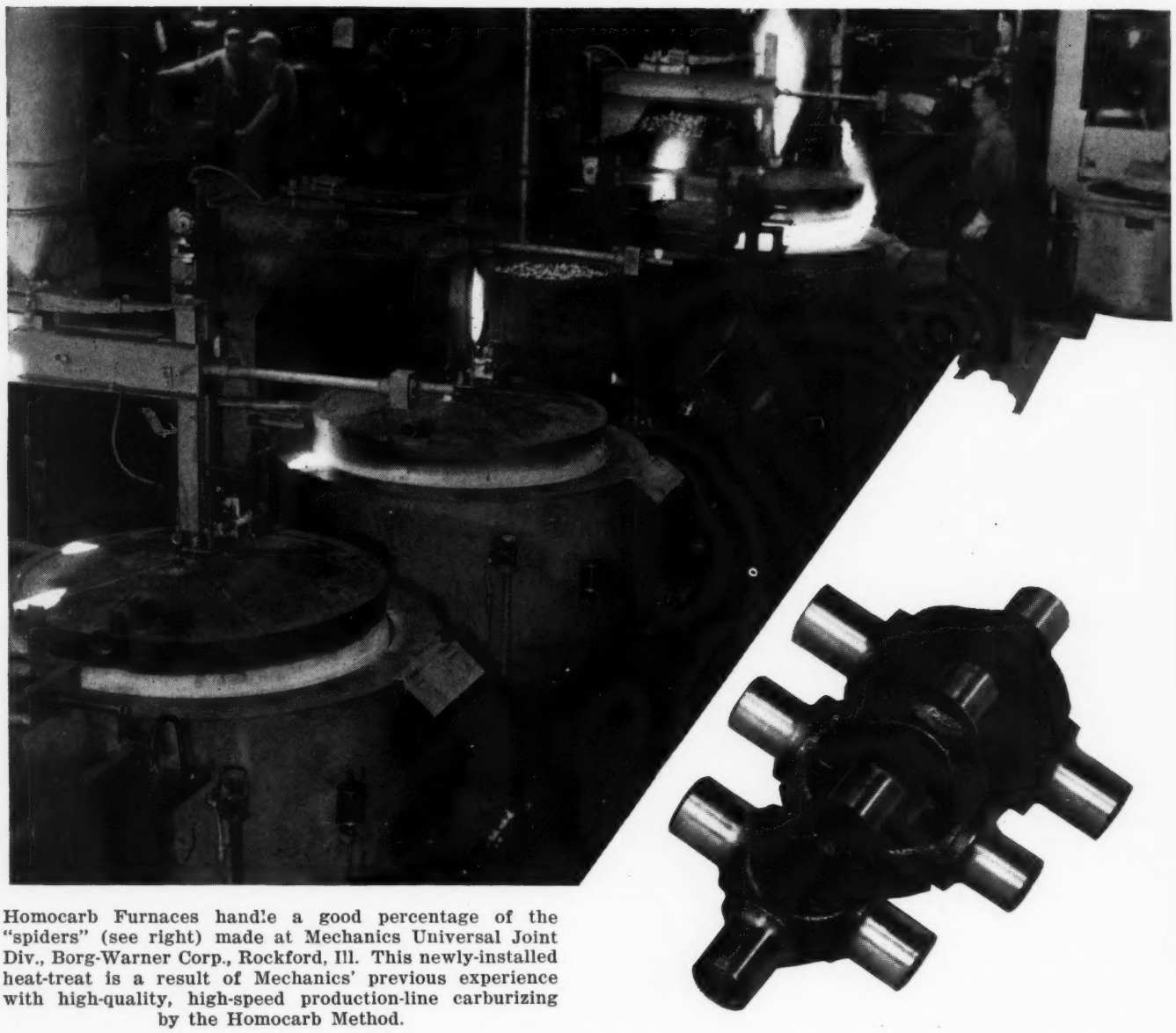

Homocarb Furnaces handle a good percentage of the "spiders" (see right) made at Mechanics Universal Joint Div., Borg-Warner Corp., Rockford, Ill. This newly-installed heat-treat is a result of Mechanics' previous experience with high-quality, high-speed production-line carburizing by the Homocarb Method.

Production Line Carburizing with HOMOCARB

"Mechanics" produces propeller shafts for many makes of automobiles and trucks, plus a variety of aviation, railroad, and agricultural machinery. Each shaft requires two of the spiders shown above, so that the total production of spiders alone runs into several tons per day.

The spiders pass smoothly along a modern production line, which has annealing, rough machining, carburizing, tempering, and finishing operations practically side by side. Because the three Homocarbs fit right into this stream, Mechanics saves the time, labor, and equipment that go into handling when the heat-treat is distant from the machine operations.

Homocarb can be an integral part of the production line because it is a clean process, relatively cool and requires only the type of building used for normal machining operations. Men find the working conditions comparable to others in the area with no handling of dusty carburizing compounds or hot salts. The work is delivered clean and ready for the next process.

For a description of the Homocarb Method, write for Catalog T-623. To discuss a specific problem, ask an L&N field engineer to call. Address Leeds & Northrup Co., 4921 Stenton Avenue, Philadelphia 44, Pa.

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LEEDS & NORTHRUP CO.

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Here's a Money Saving Answer

Do You Have a Stamping-Trimming Problem?

Whiting Stamping-Trimmer with universal hold-down trims stainless ladles in a variety of sizes.

Here's a Money Saving Answer

Do You Have a Beading Problem?

Roll tooling used to form irregular contour on side of 9" diam stamping. Tolerance maintained ± .003". Production rate, 400 to 500 pieces per hour.

Here's a Money Saving Answer

Do You Have a Forming Problem?

Equipment shown is set up for forming a groove at the top of a food container. This "necking in" operation was accomplished at the rate of 250 to 300 pieces per hour.

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WHITING CORPORATION

HARVEY, ILLINOIS

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M-249

WHITING

STAMPING TRIMMERS

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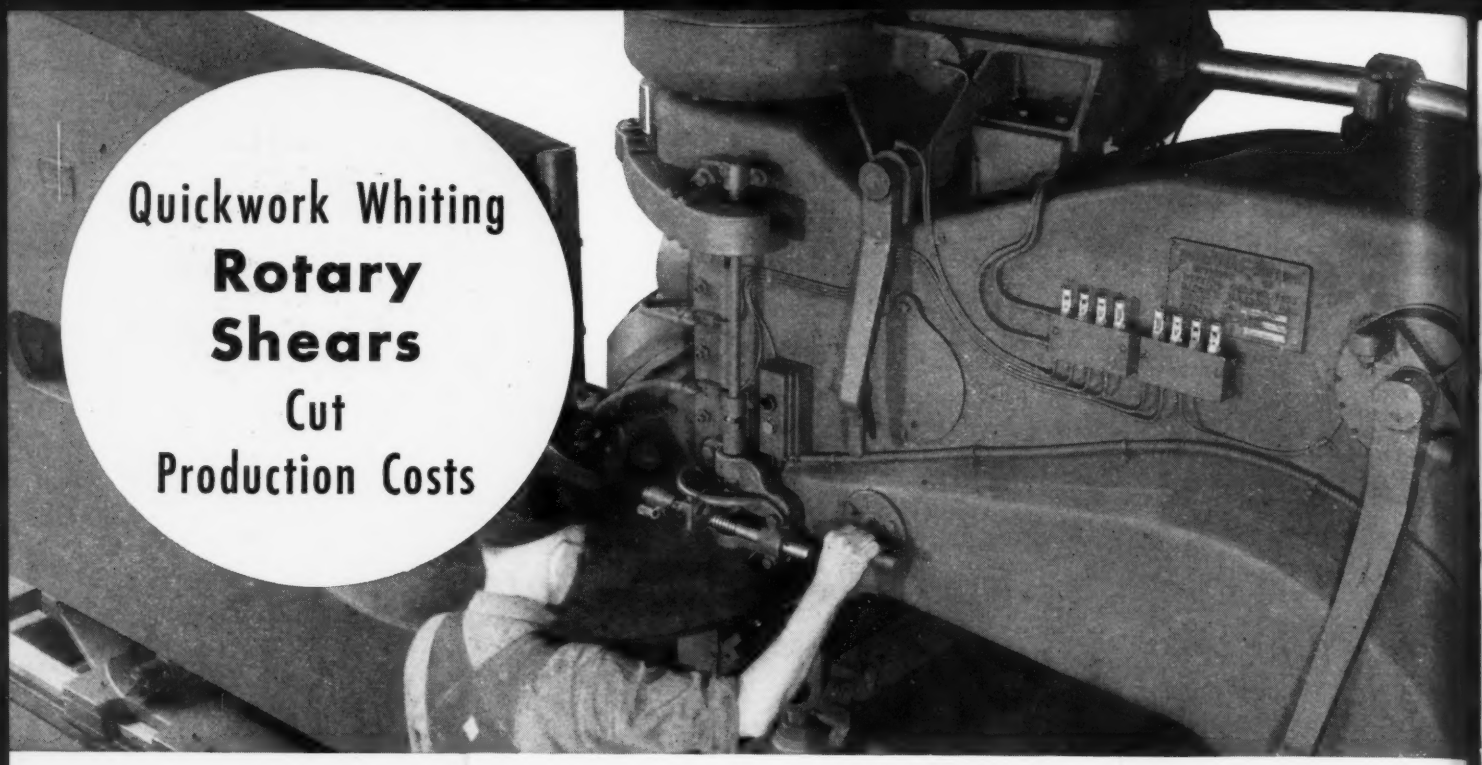
See Next Page for Listings

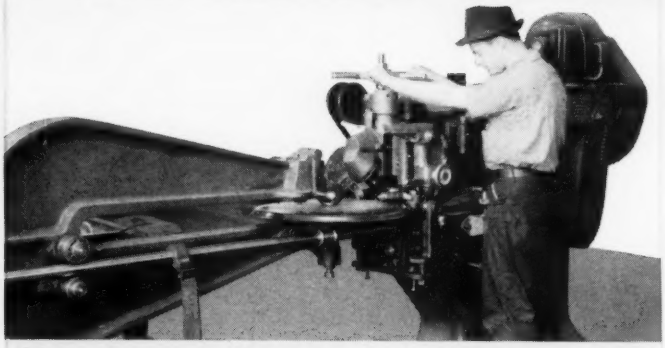
QUICKWORK WHITING ROTARY SHEARS



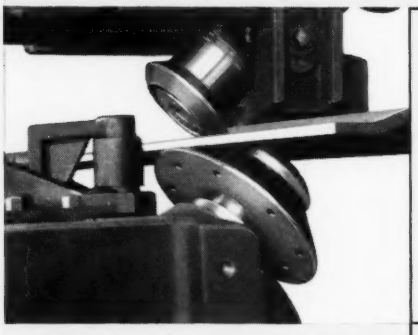
Quickwork Whiting **Rotary Shears** Cut Production Costs

ONE MACHINE WITH ATTACHMENTS HANDLES ALL THESE JOBS

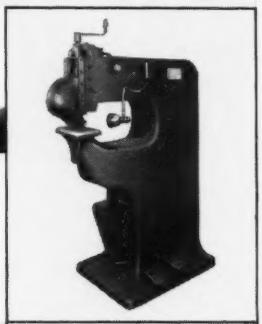
1. **Cuts straight lines**
2. **Cuts openings**
3. **Cuts odd shapes**
4. **Slits narrow strips**
5. **Bevels**
6. **Cuts circles**
7. **Forms flanges**
8. **Joggles**



● Flanging is another of the Quickwork operations. In reality a spinning operation, the work is fast requiring only from 4 to 7 passes.



● Standard joggling rolls are quickly attached —adjustable for different metal thicknesses.



● Model 8A Quickwork Shear—for sheets up to ⅛".

Capacities to 1-inch Mild Steel

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Know All About Them

- ☐ Whiting Stamping Trimmer
- ☐ Quickwork Whiting Rotary Shears

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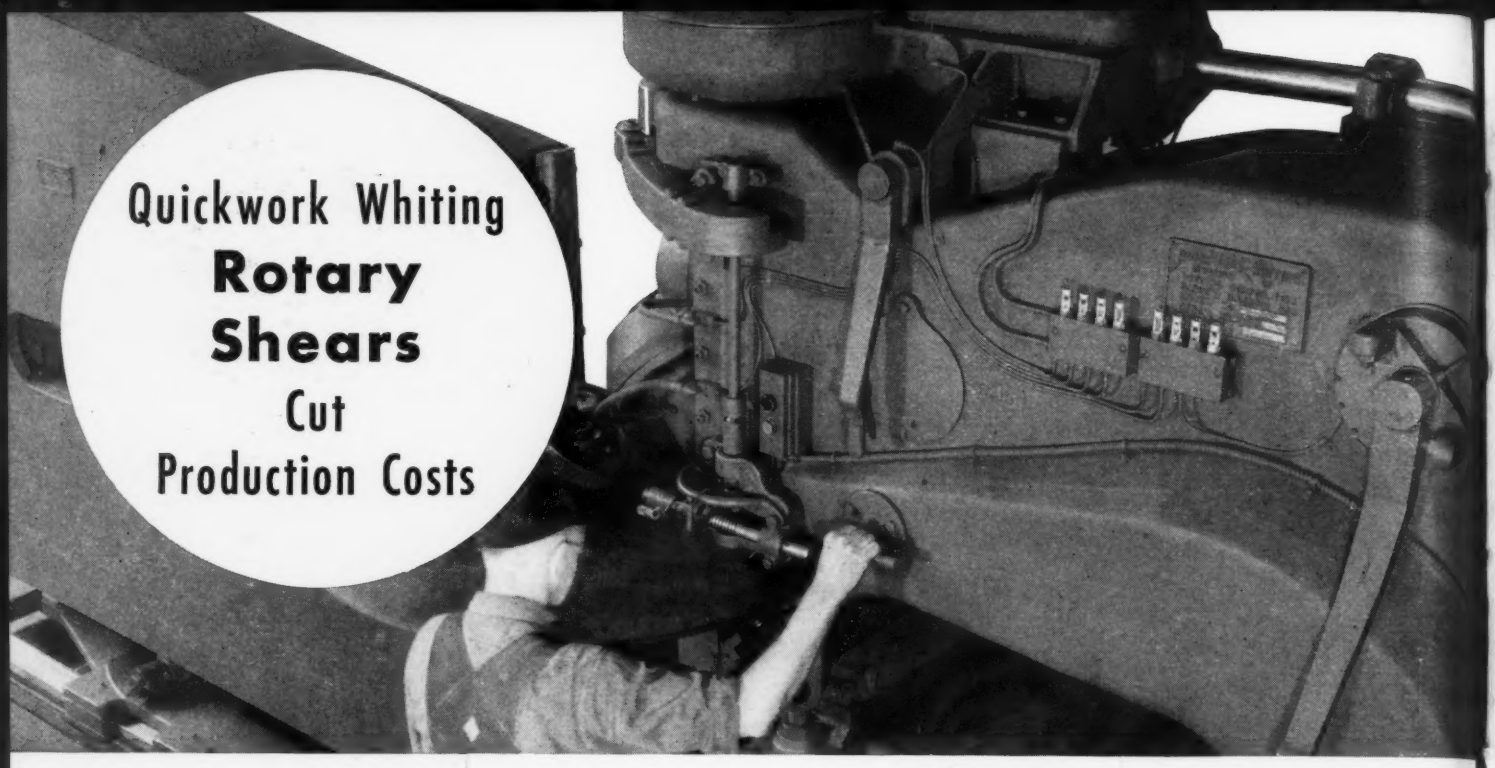

Quickwork Whiting **Rotary Shears** Cut Production Costs

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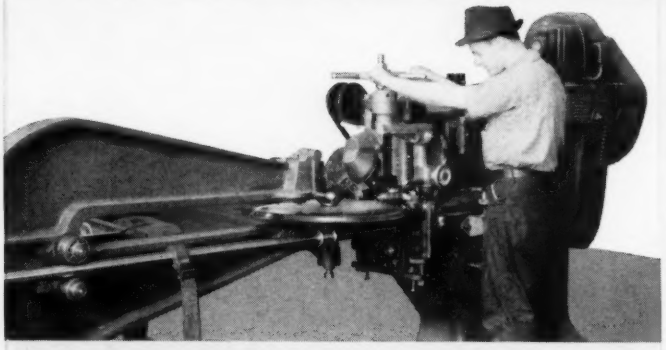

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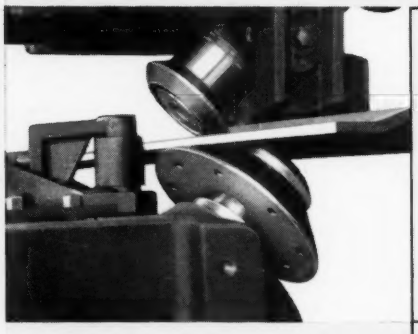

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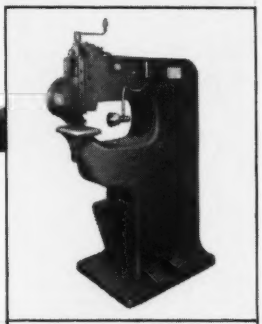

● Model 8A Quickwork Shear—for sheets up to ⅛".

Capacities to 1-inch Mild Steel

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WHITING METALWORKING TOOLS

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- ☐ Whiting Stamping Trimmer
- ☐ Quickwork Whiting Rotary Shears

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Want to CUT COSTS? See EX-CELL-O

EX-CELL-O Special Machine Combines Operations to Save Handling... Save Man Hours... Save Space

This Ex-Cell-O Special Machine for turning the tapered ellipse on automotive pistons does a complicated machining job while still maintaining a high rate of production and fine finish. Ex-Cell-O used as a basis for this operation a standard Style 61 Precision Cylinder Boring Machine. Production is 180 pieces per hour net. The engineering "know-how" that makes a job like this possible is available to you through Ex-Cell-O. Write Ex-Cell-O in Detroit today!

49-8

EX-CELL-O CORPORATION DETROIT 32

Special Multiple Way-Type Precision Boring Machines • Special Multiple Precision Drilling Machines • Precision Boring, Turning, and Facing Machines and Fixtures • Precision Cylinder Boring Machines • Precision Thread Grinding Machines • Precision Lapping Machines • Precision Broach Sharpening Machines • Other Special Purpose Machines • Tool Grinders • Continental Cutting Tools • Broaches and Broach Fixtures • Counterbore Sets • Grinding Spindles Hydraulic Power Units • Drill Jig Bushings • R.R. Pins and Bushings • Fuel Injection Equipment • Dairy Equipment • Aircraft and Miscellaneous Production Parts

BIGGER DIVIDENDS

with MURCHEY MODERN THREADING TOOLS

Here's why—**Fullest value and biggest dividends from your machine tool investment come only from the use of modern, efficient metal removing tools.**

Murchey collapsible taps, self-opening die heads, and special threading tools represent the newest, most modern threading tools of their kind available to industry. They have been engineered to the pace set by modern production requirements. Outstanding and exclusive features contribute to *lowest cost per thread.*

Call for a Murchey man to work with you on your threading problems—no obligation.

Catalogue available upon request.

Lowest cost per thread . . .
WITH MURCHEY TOOLS

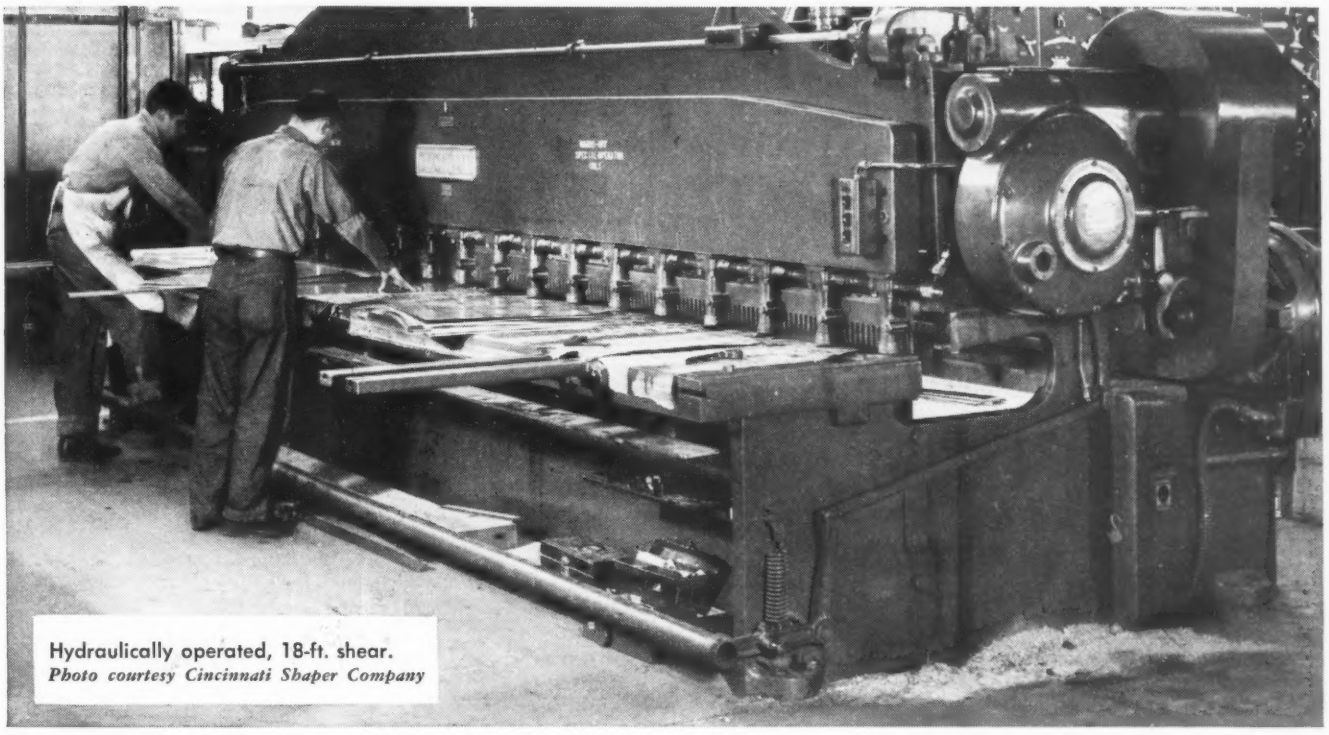
Manufacturers of collapsible taps, self-opening die heads (tangent and radial chaser types) and special threading tools

MURCHEY MACHINE & TOOL CO.

MURCHEY

SUBSIDIARY OF THE SHEFFIELD CORP.
DAYTON 1, OHIO, U. S. A.

STOP rust and sludge BEFORE THEY START



Hydraulically operated, 18-ft. shear.
Photo courtesy Cincinnati Shaper Company

Keep hydraulic systems clean by using Texaco Regal Oils (R&O)

You by-pass a lot of trouble and expense when you use *Texaco Regal Oils (R & O)* to assure smooth, trouble-free operation in your hydraulic systems. These turbine-grade oils are inhibited against rust and oxidation, and have been specially processed to prevent foaming.

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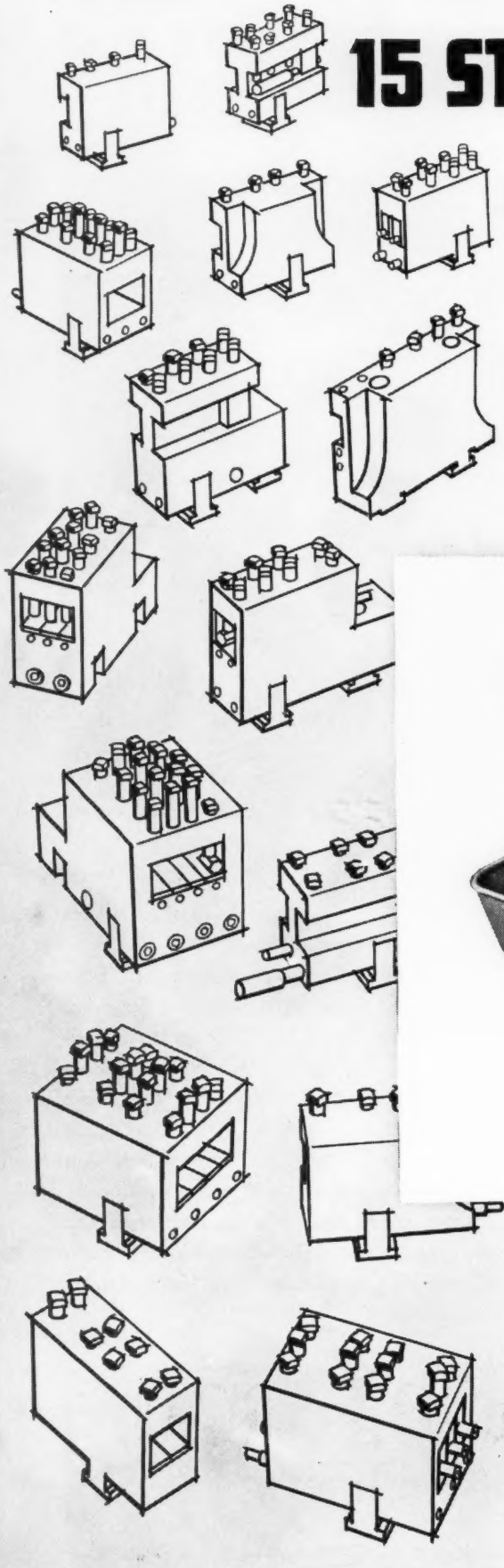

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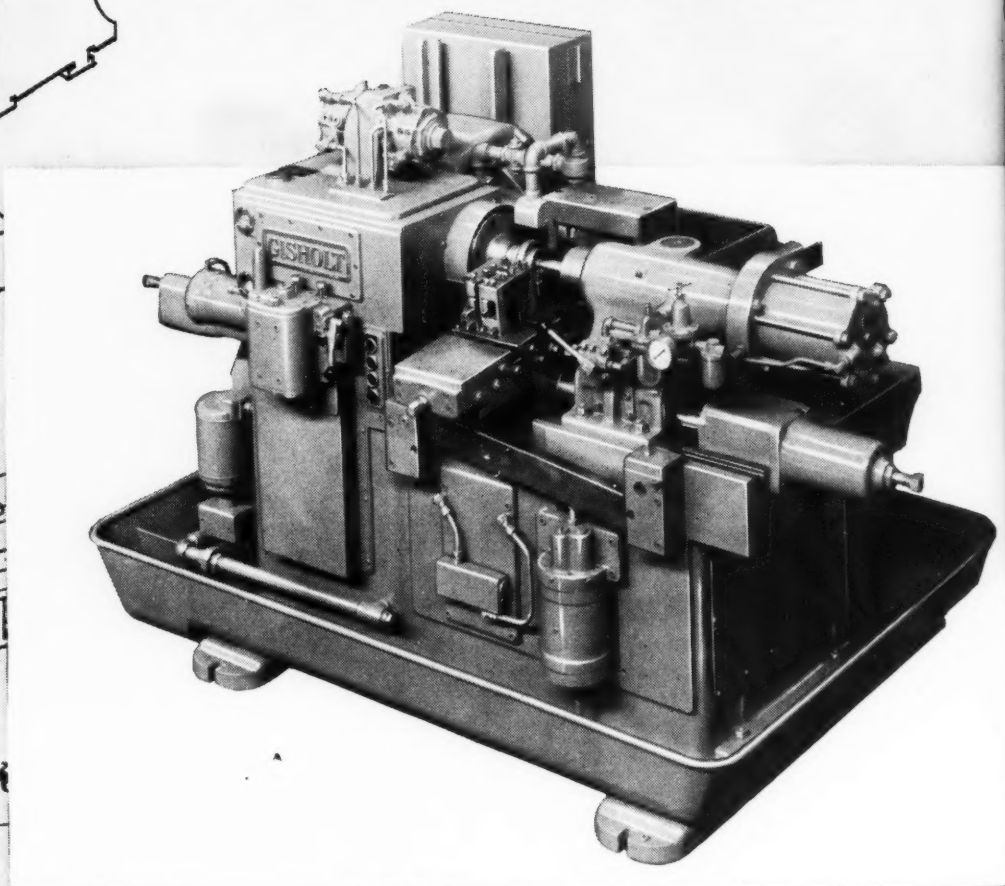

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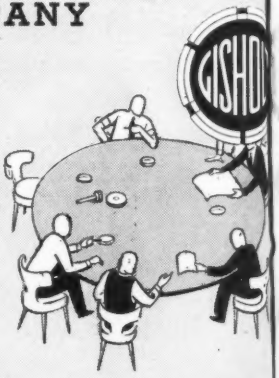

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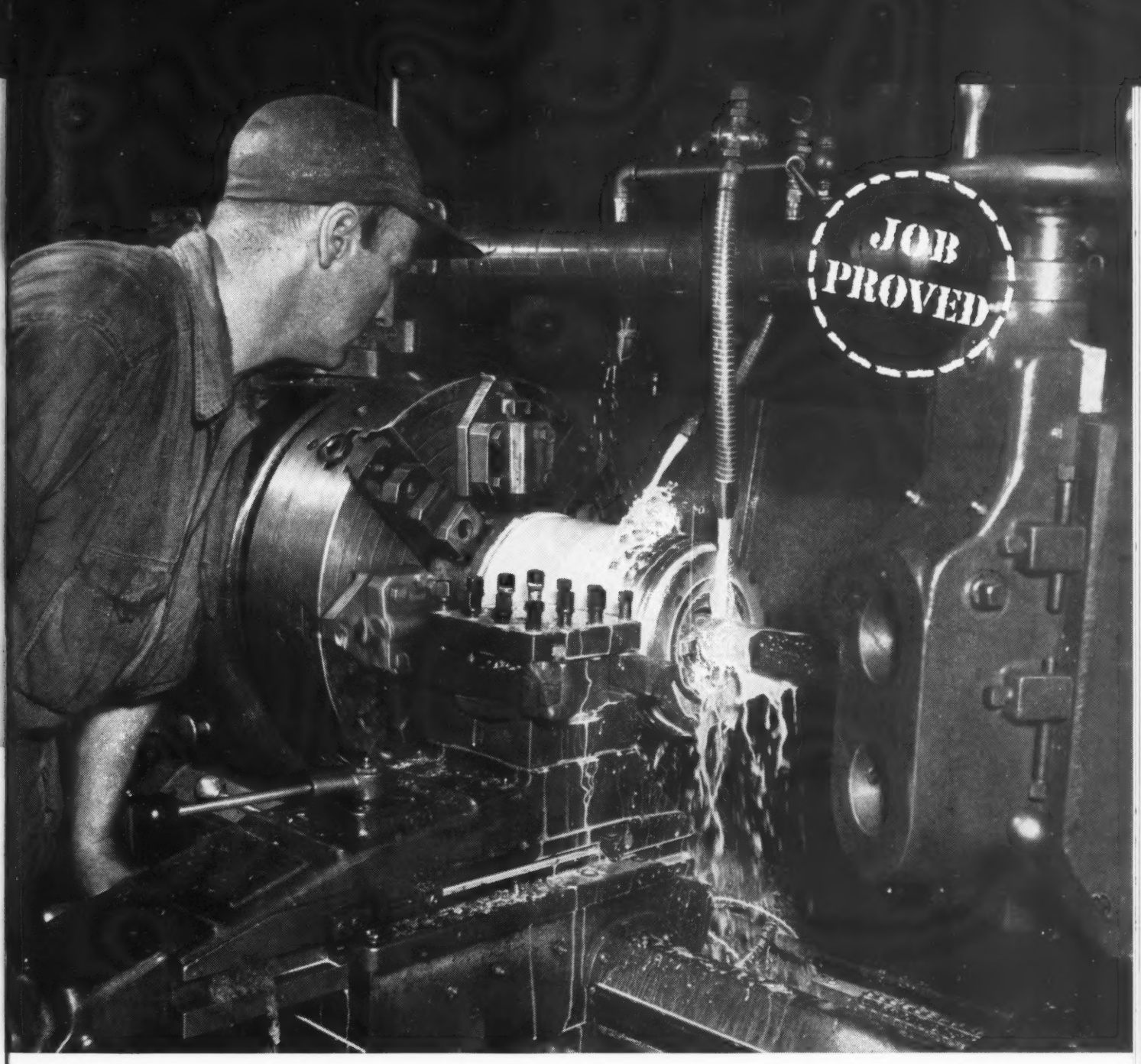

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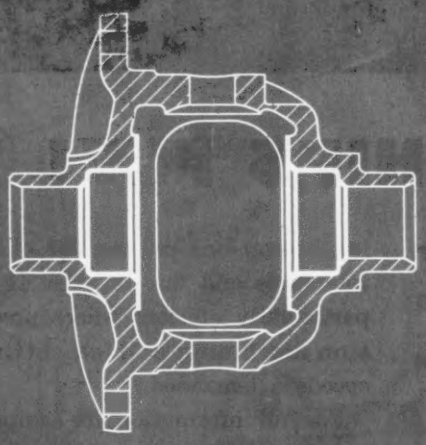

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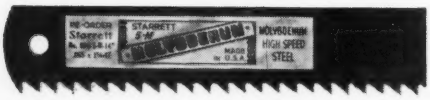

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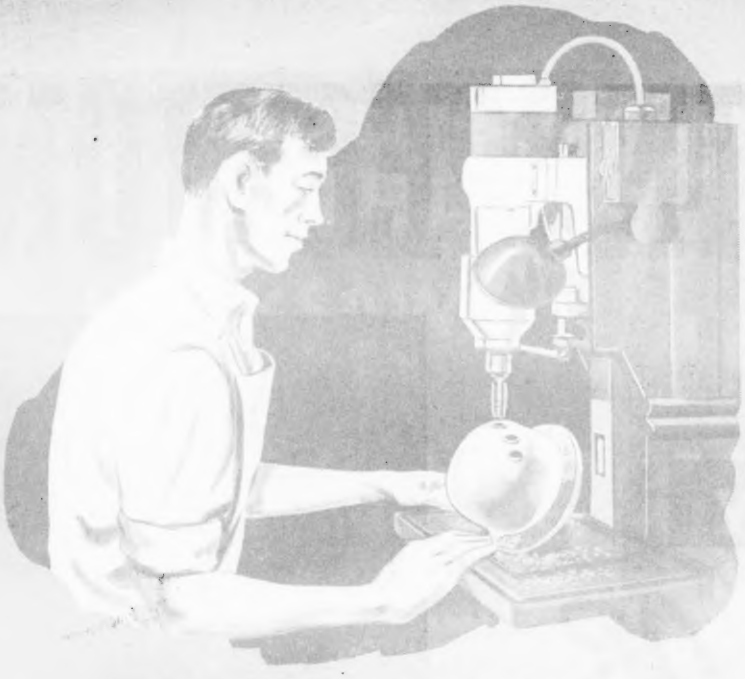

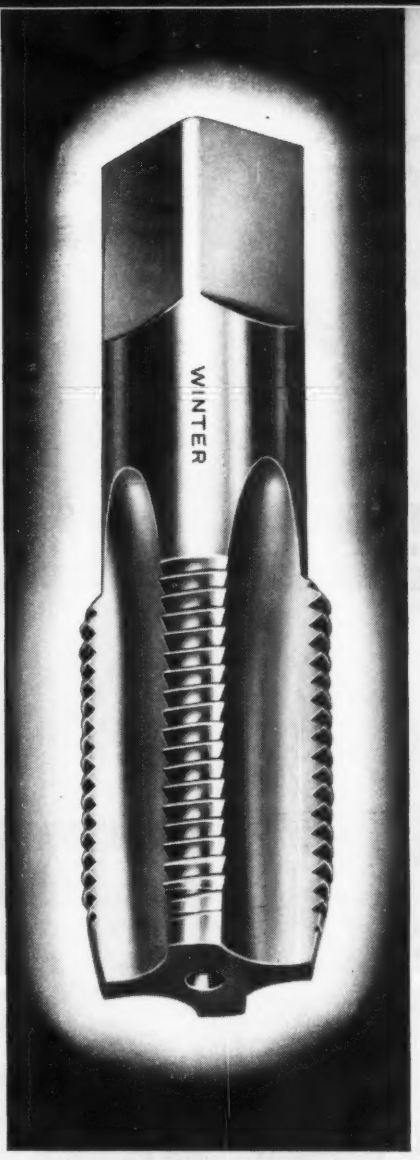

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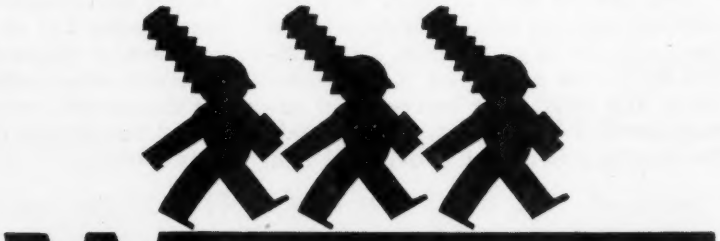

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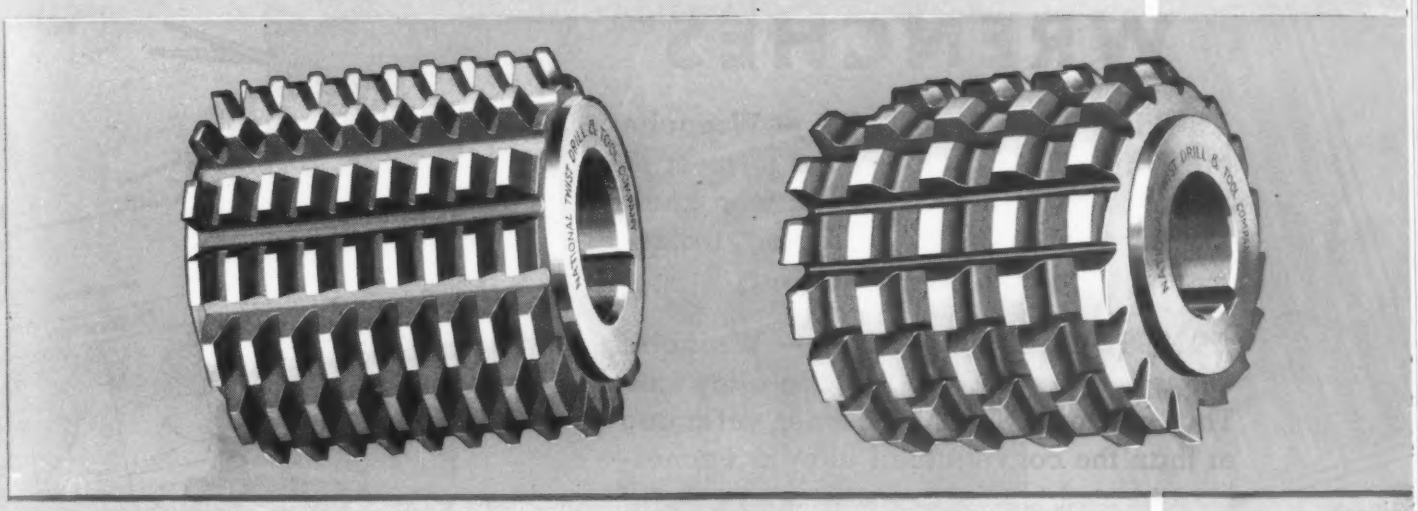

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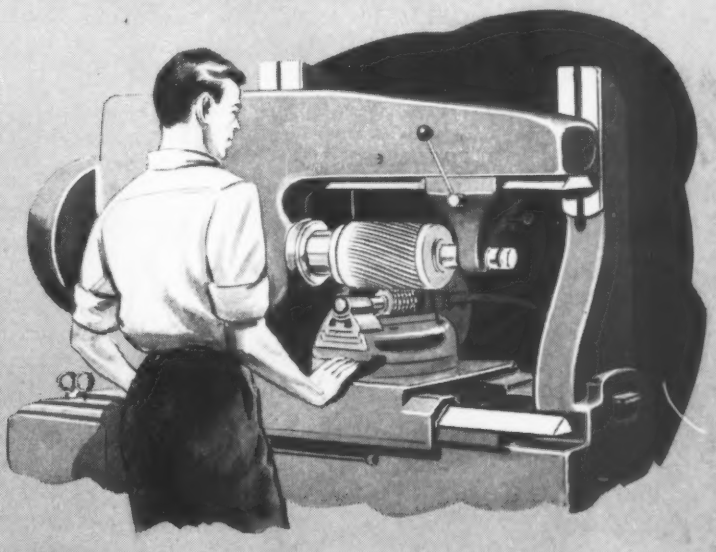

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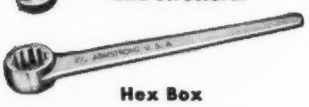
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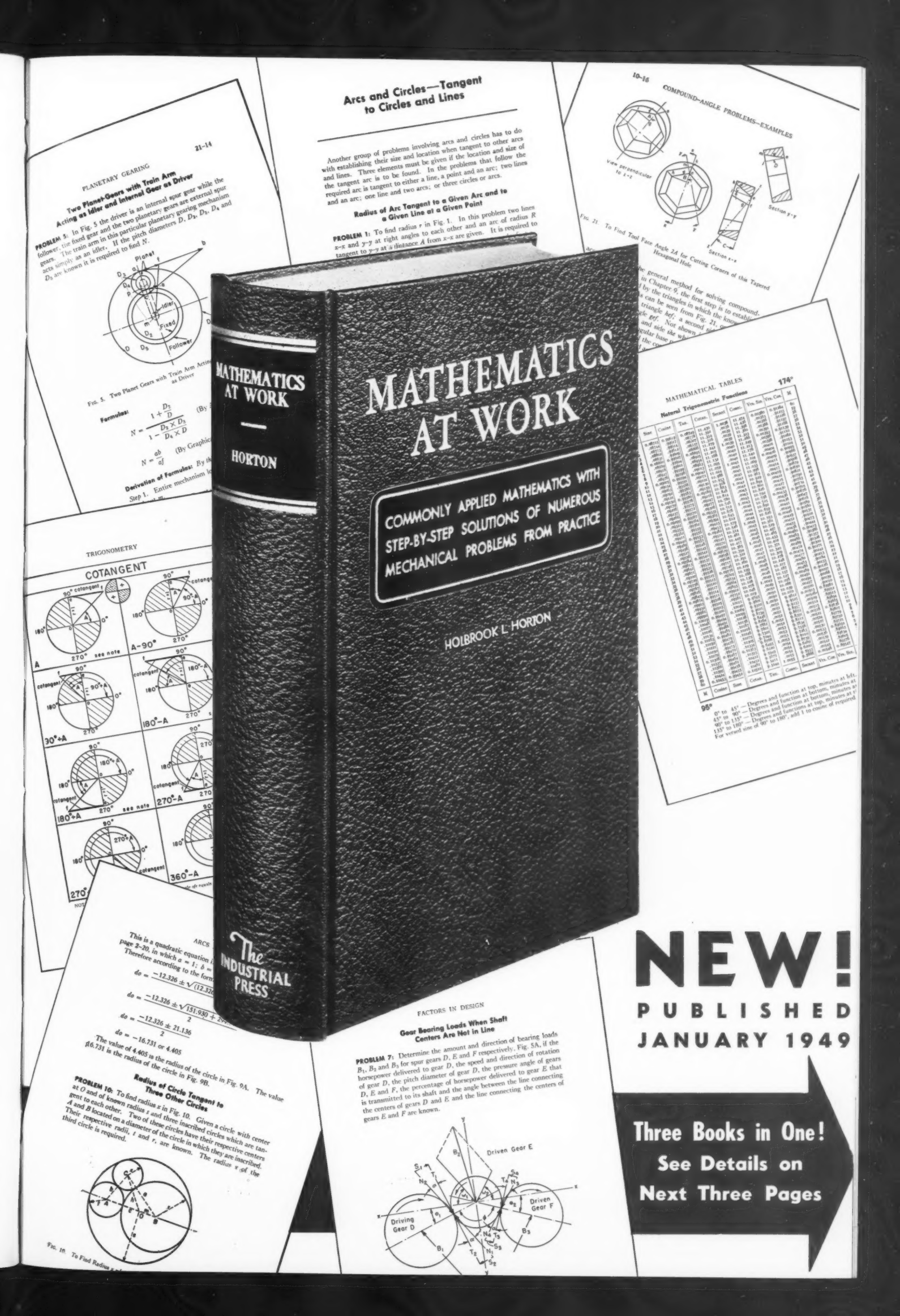
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How are approximate roots found to a given accuracy?

What is the meaning of "factorials"?

How are simultaneous equations solved?

What are the four possible cases in solving an oblique-angled triangle when two sides and the angle opposite one of them are known?

What method facilitates the use of logarithms of numbers less than 1?

How is the decimal root of a number obtained by logarithms?

How is the fractional power of a number obtained by logarithms?

How can a right-angled triangle be solved when one side, part of the other side and part of one angle are known?

How can the location of two intersecting tapers be established?

How can the angle of elevation of a vee-block for supporting a tapered part in a horizontal position be computed?

What are four common types of compound angle problems and how are they analyzed?

How is the radius of a circle tangent to three given circles found?

How can the center of an arc tangent to a given line and passing through a given point be found?

How can an unsymmetrical V-shaped groove be checked by measurement over pins?

How can the outside diameter of a spline with an odd number of teeth be found by measurement over pins?

What are two methods of dividing a circle into a given number of equal parts?

What are three approximate formulas for the area of a circular segment and when is each used?

What are two methods of finding the approximate areas of irregular plane figures?

How can the approximate periphery of an ellipse be found?

When and how are graphical solutions used for solving planetary gearing problems?

What procedure is followed in graphically solving a planetary gearing problem with two pairs of gears of different circular pitch?

What is the proper procedure for "rounding off" figures?

How can the "powers of ten" method of notation help prevent errors in the location of the decimal point?

What is the difference between rational and empirical or working formulas?

How can the length of a spiral roll of material be found?

How large a hole must be bored in a solid sphere to reduce its weight by a given amount?

How can the partial volume of a horizontal cylindrical tank be computed?

How can the efficiency of a square threaded screw and nut be determined?

What is the method of continuous fractions and how can it be applied to finding an approximate gear ratio?

What are two other methods of finding an approximate gear ratio?

How can the forces acting on the bearings of a vertical shaft be computed?

How is the force of impact of a drop hammer found?

What is the formula for finding the temperature increase required to enlarge the diameter of a steel band a given amount?

What are the versed sine and coversed sine of an angle and where are they used?

Is there any satisfactory method of finding the square root of a number other than by the customary "long-hand" method or by the use of logarithms?

Can the process of interpolation be expressed by a formula?

How does the weight of a body vary with relation to its position above or below the surface of the earth?

When can the radius to the center of gravity of a body be substituted for the radius to the center of mass as in the case of computing centrifugal force?

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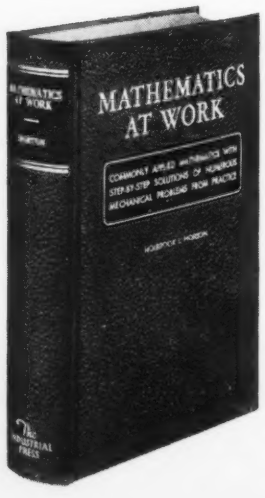


THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y.

Please send me a copy of MATHEMATICS AT WORK. I understand that if I am not fully satisfied I may return the book within 5 days and you will refund my money.

☐ **I enclose payment in full (including foreign postage if necessary).**

☐ **I enclose first payment of $2.00 and will pay balance in two monthly installments of $2.00 each. (Canadian or foreign orders must be accompanied by payment in full).**

Name.....

Home Address.....

City.....**Zone**.....**State**.....

Firm*.....**Position***.....

*This information would be appreciated for our records.

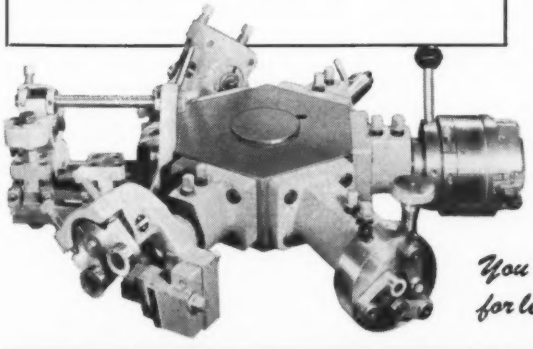
M-2-49

PICTURE OF A MAN PRODUCING 25% MORE

Same job, same operation, *But Better Tools!*

This shop has found it can do more jobs faster on Warner & Swasey Turret Lathes with the Standard Tooling Setups that fit their requirements. Multiple and combined cuts, with shorter setup time, mean profitable production increases.

● Electrol Incorporated, of Kingston, New York, transferred this precision Stop-Plunger job to a Warner & Swasey No. 3 Universal Turret Lathe because it had the speed and accuracy required, as well as the proper tooling for the job. The result was a 25% increase in production of this high pressure hydraulic control part.



Permanent Universal Tooling setups and the right tools which can help you increase your output are all in the new 194 page Warner & Swasey Tool Catalog. Write for your copy.

You can machine it better, faster, for less... with a Warner & Swasey

WARNER & SWASEY
Machine Tools
Cleveland

TURRET LATHES, MULTIPLE & SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

The four new Sterling folders are now at the printers. Send for yours today.

STE

WHERE YOUR AND PERFECTION

"THE WHEELS OF INDUSTRY"
STERLING
GRINDING WHEELS

AN EXAMPLE OF STERLING'S PRODUCT DEVELOPMENT TECHNIQUE

In the view above, Sterling technicians are mixing and weighing the bond and grain to be absolutely certain it meets the requirements of your special wheel formula.

The Sterling Portable Wheels, shown to the left, are but one example of many different types from which better results can be obtained . . . thanks to Sterling research.

GRINDING WHEEL'S PERFORMANCE ARE MEASURED IN GRAMS . . . . .

THE fine line of quality can never be drawn too thin. That is why Sterling automatically measures the bond and grain for your "Wheels of Industry" in specially designed equipment and weighs it to fraction-of-a-gram accuracy.

The interest in your grinding welfare indicated by this accurate, controlled mixing of your grinding wheel's ingredients is matched by every other Sterling manufacturing operation. It is in keeping with the exacting requirements of Sterling's New Research and Development Program which, after years of planning, is now available to you.

Conceived as a new idea in cooperation between manufacturer and customer, Sterling's New Research and Development Program offers faster, more detailed study of your grinding problems than has ever before been possible. Through its application, your special problems are studied by Sterling engineers and solved by Sterling Grinding Wheels, built to your particular needs. A letter from you will bring full explanation. May we serve you?

Sterling Research and Development in Action

FIRST STEP . . . The call of the Sterling engineer on your operator involves no obligation, but always starts an investigation which results in faster, better production.

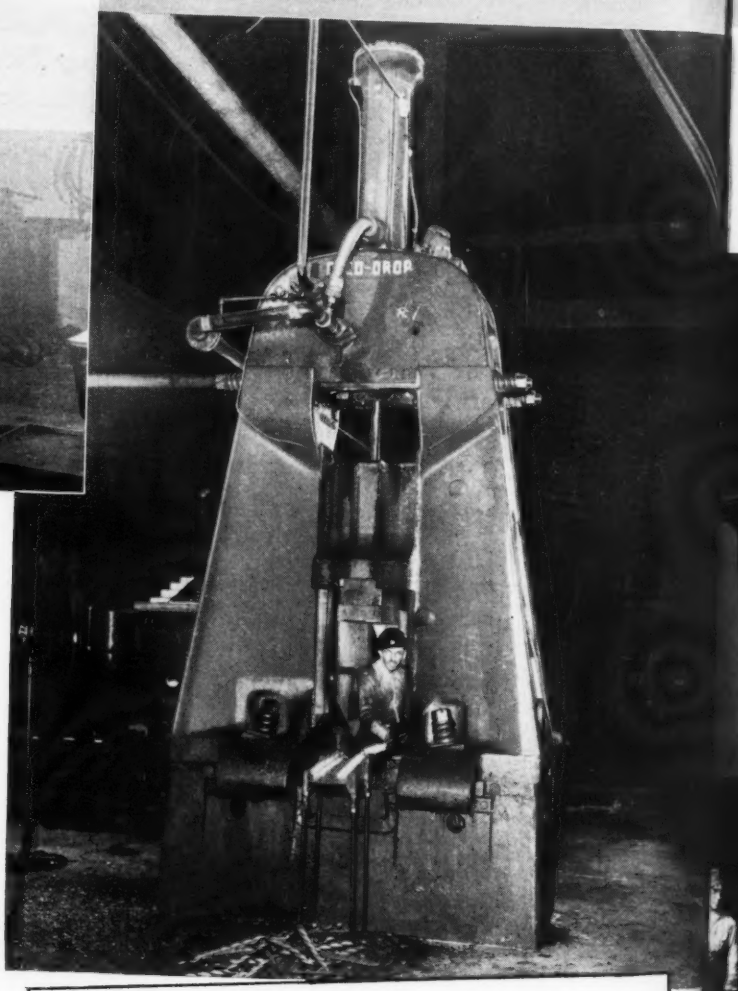
SECOND STEP . The Sterling engineer's study of your problem is a "shirt sleeve" proposition. Here, his practical experience on hundreds of grinding jobs means a lot

THIRD STEP . Back at Sterling, the combined knowledge of a committee of grinding experts is applied to the engineer's recommendation

FOURTH STEP . The better performance of the new Sterling Grinding Wheel on your machine, reflects the wisdom of securing the advice of Sterling's technicians.

THE STERLING GRINDING WHEEL DIVISION
of
THE CLEVELAND QUARRIES CO.
TIFFIN, OHIO
Since 1885, Manufacturers of "The Wheels of Industry"

The Fulfil
OF THE
CECO



In shop after shop, over the past two years, the CECO-DROP has proved

- **IT FORGES MORE MINUTES PER HOUR**
- **IT COSTS LESS TO OPERATE**
- **IT IS SAFER**
- **RE-ORDERS TELL THE STORY**

The Ceco-Drop is a gravity drop hammer in which the ram is lifted by air or steam rather than by friction operated boards. There are fewer operating parts, shock-absorbing mechanisms are employed, lubrication is automatic and operation is simple and safe.

...ment OF THE PROMISE

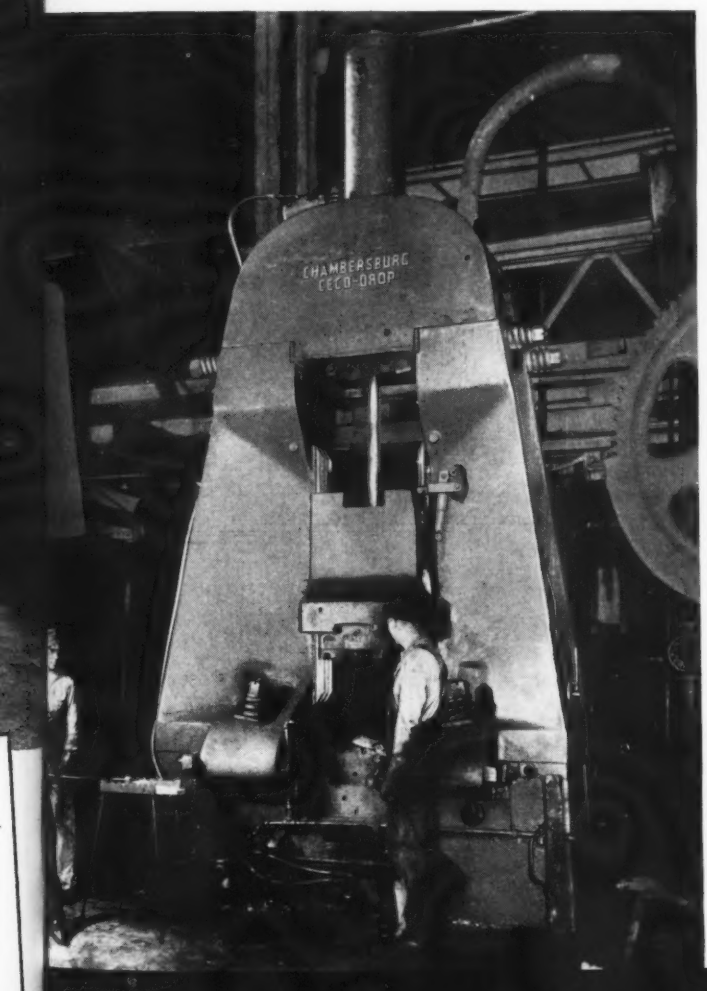
...DROP

SHOP RECORDS

(Facts on File . . . Ask for Details)

"The Ceco-Drop produces 35% more forgings than our board drop hammers."

"The Ceco-Drop made 5100 pieces in a 9-hour shift . . . the board drop 3700."



"The men in the shop are all for it."

• • • •

218 pieces per hour on a board drop hammer. 222 to 250 pieces per hour on the Ceco-Drop.

• • • •

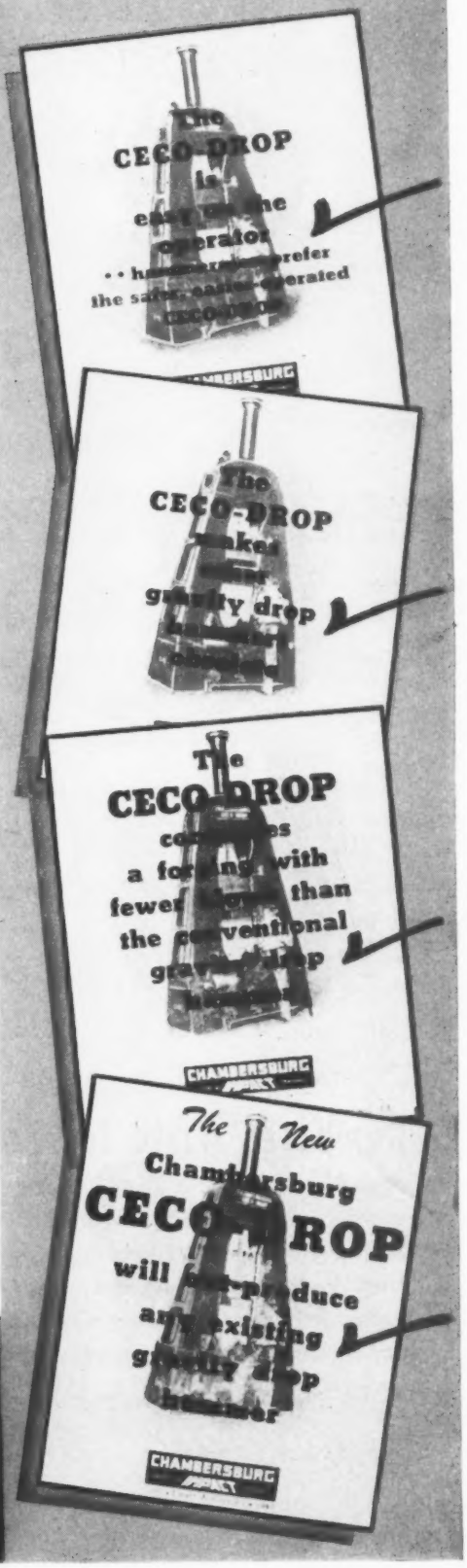
"The superintendent calls it 'The Hammer of the Future'."

• • • •

"Original rod is still in use . . . after a year's service."

• • • •

"More and better forgings than on our board drops."

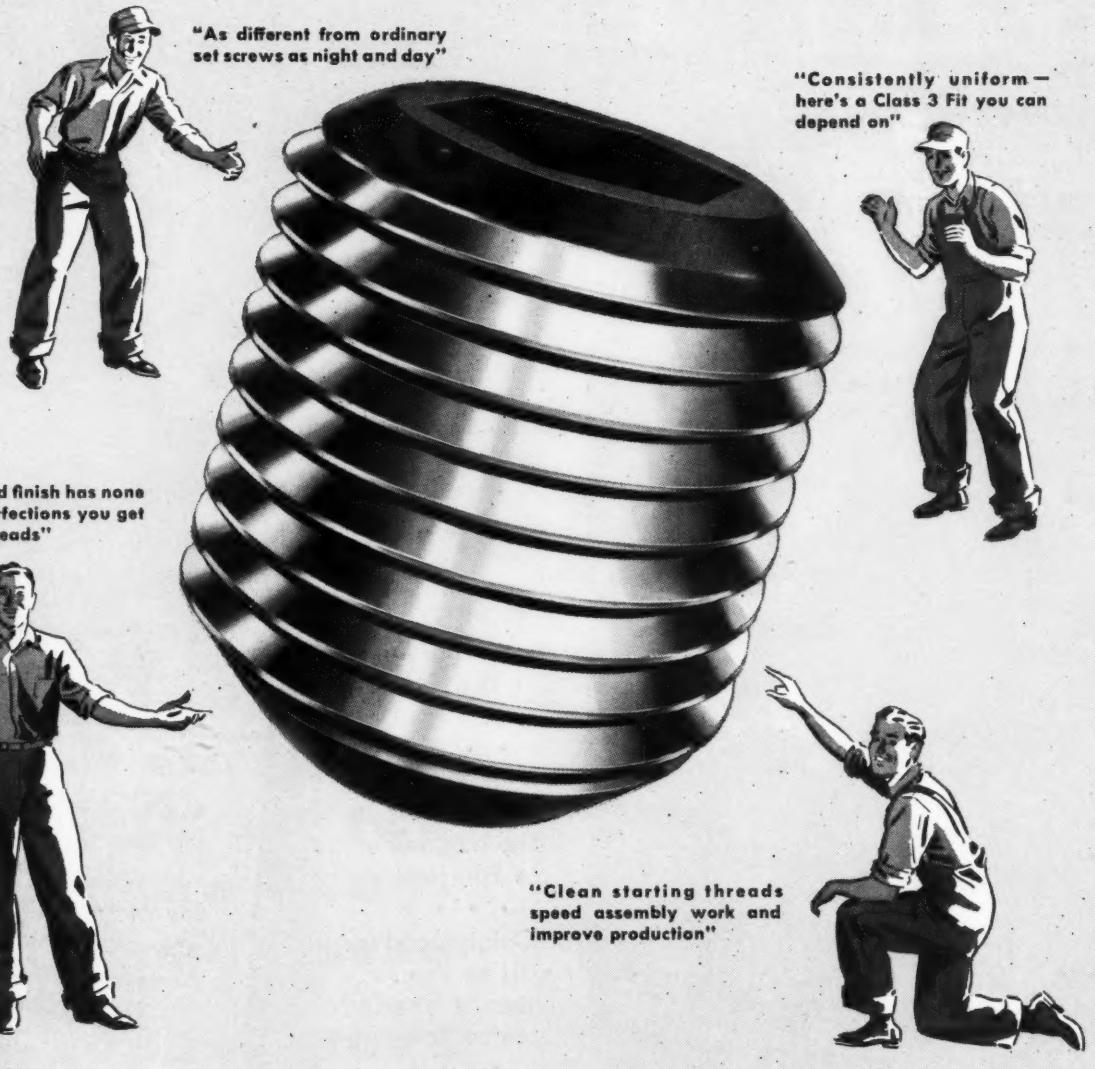


CHAMBERSBURG ENGINEERING CO.

Builders of Impact Machinery Since 1897

CHAMBERSBURG, PENNSYLVANIA

Parker-Kalon GROUND THREAD Socket Set Screws are The TALK of the SHOP!


"As different from ordinary set screws as night and day"
"Consistently uniform — here's a Class 3 Fit you can depend on"
"True ground finish has none of the imperfections you get with cut threads"
"Clean starting threads speed assembly work and improve production"

Compare! Write for Samples!

See why P-K Ground Thread Socket Set Screws speed assemblies, improve strength and safety. Thread grinding, once reserved for screws used in the finest precision equipment, now gives Parker-Kalon Socket Set Screws the accurate finish and faultless contour that mean faster assembly and more sales for your products. Write for samples today.

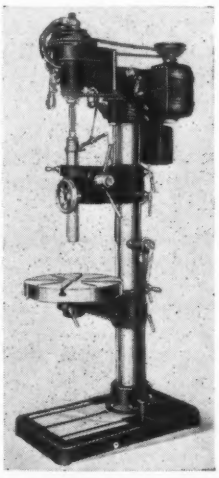
AVAILABLE FOR PROMPT DELIVERY

PARKER-KALON CORPORATION
202 Varick Street
New York 14, N. Y.

SOLD ONLY THROUGH ACCREDITED DISTRIBUTORS

Easy Handling -Fast Set up Changes

Speed up the LARGE DRILL Operations with "Buffalo" No. 22 Drills



● Drilling up to 2" holes in cast iron no longer requires a cumbersome, hard-to-operate machine! The "Buffalo" No. 22 Drill combines the necessary rigid strength for such drilling with quick maneuverability of controls. Many manufacturers are slashing time and costs on large holes with this accurate, easily handled machine. Available in single or multispindle models, as your operation requires.

Get Bulletin 2989-F for your files! Look into the many sound engineering features of the No. 22 that mean better turn-out for you on the large-hole jobs!

MACHINE TOOLS BY "Buffalo"

PUTTING MORE PROFIT INTO YOUR OPERATION

BUFFALO FORGE COMPANY

440 BROADWAY BUFFALO, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

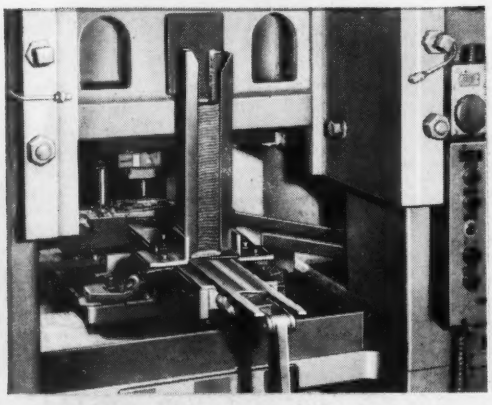
DRILLING PUNCHING
SHEARING CUTTING
BENDING

HOW 2600 PIECES PER HOUR ARE COMPLETED

on a DANLY 100-Ton PRESS

¼" Thick Bar
Pierced and Shaved
in one operation.

Danly 1-Point 100-Ton Eccentric Geared Press at Chain Belt Co., Milwaukee, handling punching operations automatically.



Close-up showing magazine feed

JOB FACTS

Part Name: Offset side bar for transmission chain.

Material: AISI 1335.

Dimensions: Length 3.706", Width 1⅝" to 1⅞", Thickness ¼".

Job: Punch two holes of approximately 9/16" and ⅞". Hold precision tolerances on hole sizes and centers.

Rate of Operation: 45 strokes per minute. Net production 2,600 pieces per hour.

Equipped with Magazine Feed

Here's how a Danly Straight-Side Press equipped with an automatic magazine feed and spring-loaded ejector cuts stamping costs by eliminating slow, hand-feeding operations. With unusual speed and precision, two holes are punched and shaved simultaneously in ¼" AISI 1335 stock. A two-step punch eliminates secondary operations. The pieces, which have been blanked and formed in a preceding operation are fed, positioned, and ejected automatically by means of a link and slide mechanism operated by an eccentric on the end of the main shaft. Operated continuously at a speed of 45 strokes per minute, a part is completed and ejected with each stroke of the press. A net production rate of 2,600 pieces per hour is attained.

Precision Tolerances Maintained

Because of the extra rigid Danly press construction including a solid-type bed, deflections are reduced to a minimum and precision tolerances maintained. Likewise, the accurate-operating Danly press slide and a 2-post Danly Precision Die Set help maintain an unusually close tolerance on the hole centers. The result is higher production and better quality at less cost.

Other Important Danly Features

Other Danly press features which contribute to high production efficiency and lower stamping costs include:

- **Built-In Automatic Oiling System**—puts right amount of clean, filtered oil where needed, *including flywheel bearings.*
- **New Floating Friction Block Clutch**—air cooled and air operated—performance tests show 8 million consecutive engagements with negligible wear.
- **Pitman Wrist-Pin Design**—assures closer operating tolerances—longer die life.
- **Extra Sturdy Welded Steel Frame**—All weldments stress-relieved before machining—assures permanent alignment—permits adapting standard or special stock handling equipment to suit needs.
- **Wide Range of Standard Press Sizes**—High production sizes from 50 to 800 tons. Straight-Side units up to 3,000 tons.

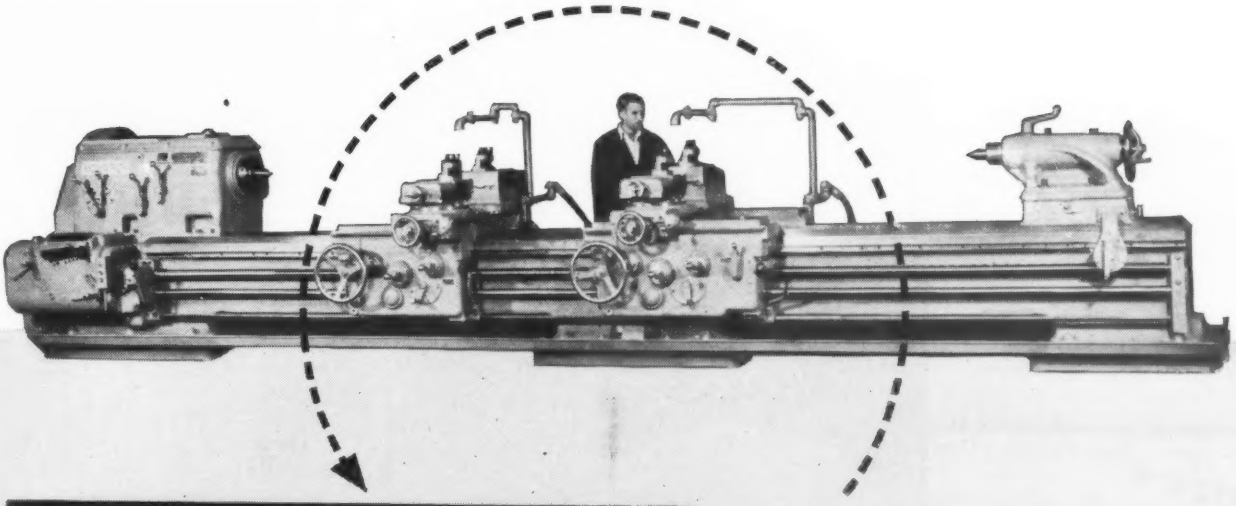
Write today for more facts on
DANLY PRESSES

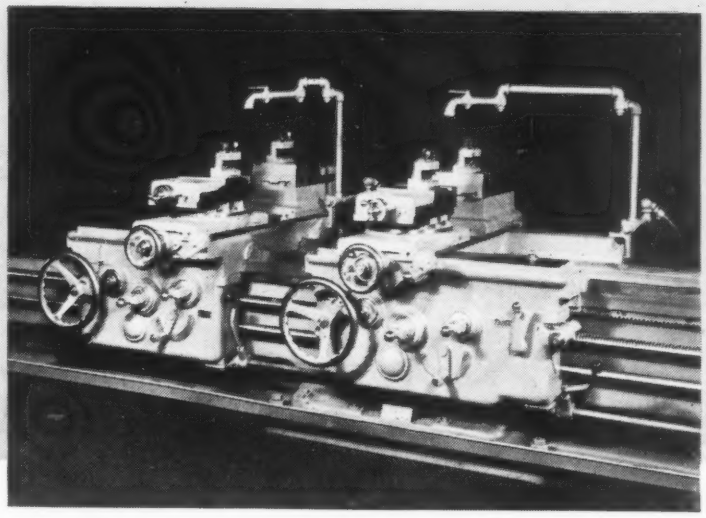
DANLY

DANLY MACHINE SPECIALTIES, INC.
2200 SOUTH 52ND AVENUE, CHICAGO 50, ILLINOIS

25 YEARS OF DEPENDABLE SERVICE TO THE STAMPING INDUSTRY

PRECISION DIE SETS...STANDARD AND SPECIAL • MECHANICAL PRESSES AND PRESS EQUIPMENT





2 Carriages... 4 Cuts... Many Uses

● To that headline we might add. "Heavy cuts in half the time—with better finish", because that's the characteristic performance of the Monarch Heavy Duty Lathes with Dual Carriages.

The use of Dual Carriages is particularly advantageous on long shaft and roll work. By dividing the over-all cut between the tools on the two carriages, both of which operate simultaneously, output is doubled.

Versatility may be increased so that the range includes both long and short work. As on the 32″ x 204″ Model NN lathe, illustrated above, the carriages are offset to the left and right to permit simultaneous cuts on short shafts without carriage wing interference.

To further reduce turning costs, the compound rests are furnished with rear rests. Independent and simultaneous feeds are provided, thus enabling the user to take four cuts simultaneously. Total amount of stock removal is divided between the front and rear cutting tools with the rear cut balancing and slightly following the front cut. Result—better finish in half the time.

These optional design pluses of Monarch Heavy Duty Lathes are in addition, of course, to the famous Monarch construction features—flame hardened and ground bedways, extra rigid bed design, helical geared headstock and the liberal use of anti-friction bearings and hardened parts throughout. All these add up to accurate, dependable, *economical* metal turning.

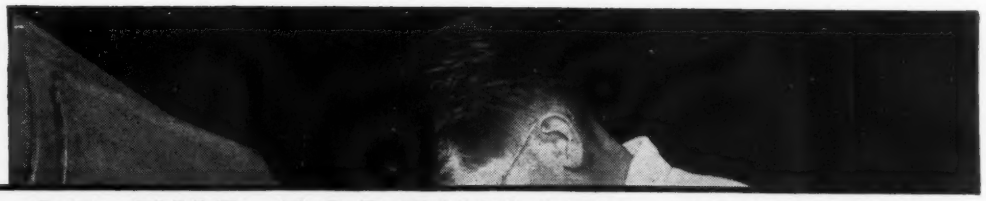
May we show you how modern Monarch Turning Machines can increase your production—and your profits?

THE MONARCH MACHINE TOOL CO., Sidney, Ohio

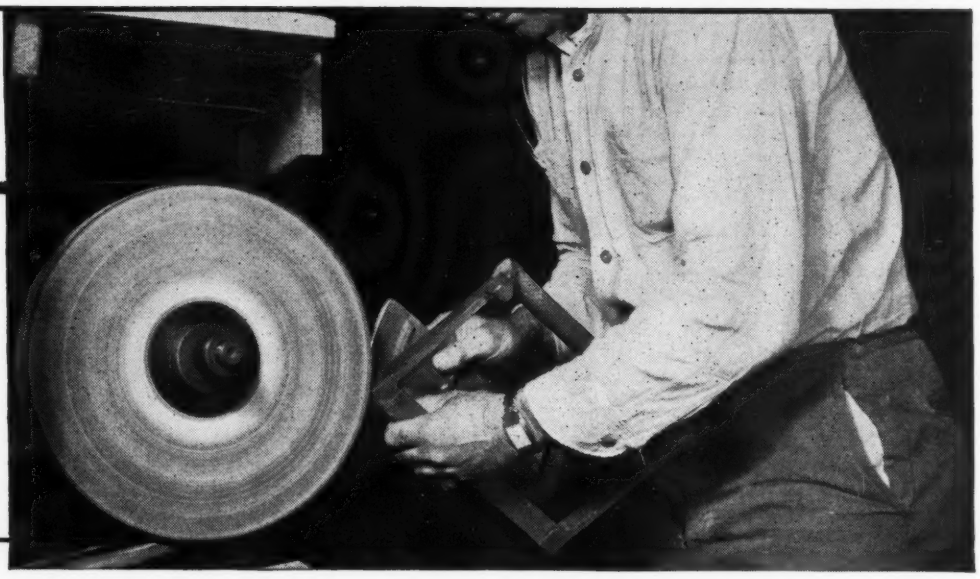
ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

MONARCH MACHINE TOOL CO. • • • Sidney, Ohio



THE CASE OF THE FORTUNATE FOUNDRY



Finds a 28% boost in finish grinding air scoop flaps with

METALITE* CLOTH BELTS

When this shop converted from set-up wheels to the belt backstand method, interruptions in production were cut 'way down, one METALITE Cloth Belt outlasting four set-up wheels, permitting almost constant production, with time-out for belt change only one minute. The operation was finish grinding the outside edges of air scoop flaps — magnesium castings. DURABONDED METALITE Cloth Belts, #50-X grit, 2" x 118", were used over soft contact wheels, 16" x 2" x 1¼" rough edge — belt speed, 8500 SFPM. Output jumped to 60 per hour — 28% over the set-up wheel method formerly used, finish was better and costs were cut substantially.

You may find it profitable to check these findings against your production, with a demonstration in your plant of the belt method with METALITE Cloth Belts. Write, wire or 'phone us to arrange it.

GET THE COMPLETE SERIES

Our booklet "Production Talks Backstands" gives you a whole series of similar case histories with convincing facts and figures. Write for your copy today.

BEHR-MANNING

* *Reg. U. S. Pat. Off.*

BEHR-MANNING · TROY, N.Y.

NORTON *abrasives*

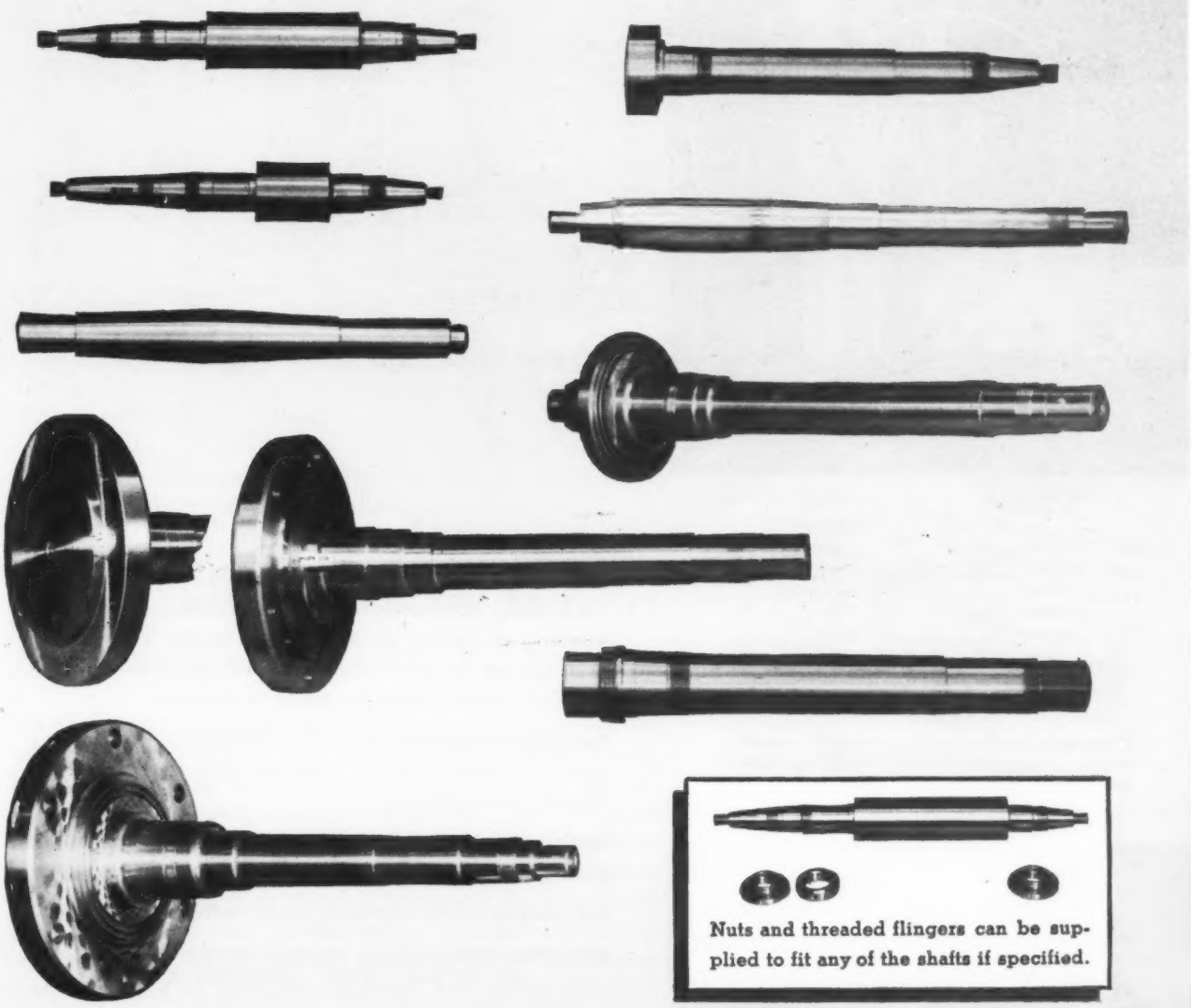
THE BELT METHOD IS THE BETTER METHOD

. . . AND THE BETTER BELT IS METALITE

POPE

PRECISION SHAFTS

We are now in a position to supply precision shafts made to your own designs and specifications as to material and tolerances, with ground threads and dynamically balanced if required.



Nuts and threaded flingers can be supplied to fit any of the shafts if specified.

Send us drawings and specifications and let us quote on your requirements

No. 57

POPE

TRADE MARK REG. U.S. PAT. OFF.

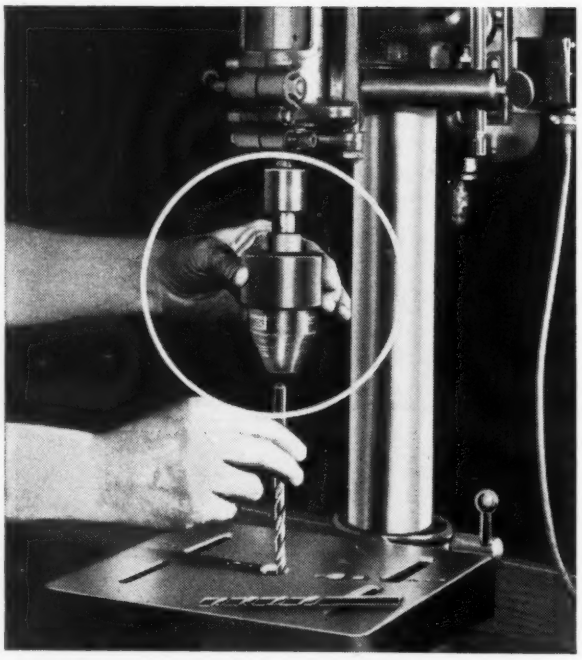
POPE MACHINERY CORPORATION

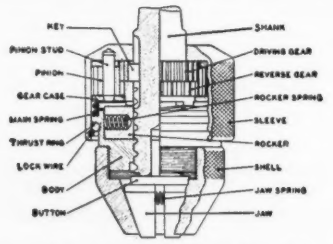
ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

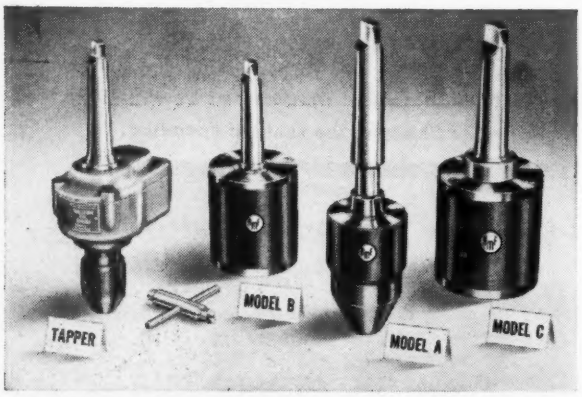
BUILDERS OF PRECISION SPINDLES

Change drills in a jiffy while spindle is running with this Automatic Chuck



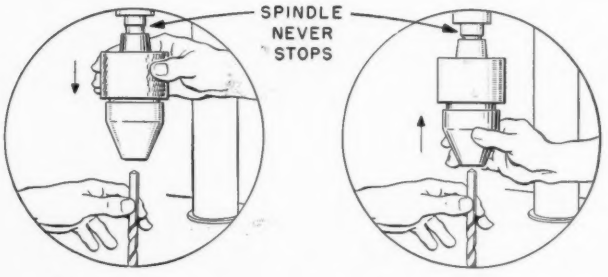


Cross-section of complete mechanism shows sturdy, compact construction of hardened and ground jaws. Tapered design gives operator full, clear view on close work.



Wahlstrom Chucks are available in several types: Models A and AA for widest range of numbered straight shank tools; Model B for larger straight shank tools; Model C for taper shank tools; Fully automatic tappers.

HERE'S ALL THERE IS TO CHANGING DRILLS



1. Grip sleeve—pull down—jaws open automatically—drill is released.

2. Insert new drill—push up tapered part—drill is locked in place.

Pull down sleeve—insert drill—push up tapered part...tool is automatically locked in place and precisely centered! *No keys, collets or wrenches needed...no stopping of machine.* That's how simple it is with the AMF WAHLSTROM CHUCK—the only *fully automatic* drill chuck which holds the widest range of numbered straight shank tools...1/32″ to 1/2″.

That's why Wahlstrom Chucks cut costly minutes in changing tools for drill press work or for spotting, drilling and reaming in boring or milling machines. They'll also save money in lathe work for burring, turning, filing, etc. One spindle does the work of several.

Tools last longer, too...smooth, hardened and ground jaws grip tight without chewing into tools. Grip increases with the load.

For fast, uninterrupted production, use the fully automatic quick-change AMF WAHLSTROM CHUCK.

See your local distributor or write today for Bulletin 56

WAHLSTROM TOOL DIVISION, AMERICAN MACHINE & FOUNDRY CO.
5502 SECOND AVENUE BROOKLYN 20, N. Y.

WAHLSTROM
fully automatic
CHUCKS
NO KEYS, COLLETS OR WRENCHES

SPECIAL

MOTCH & MERRYWEATHER CIRCULAR SAWING MACHINES

. . and we mean *Special!*

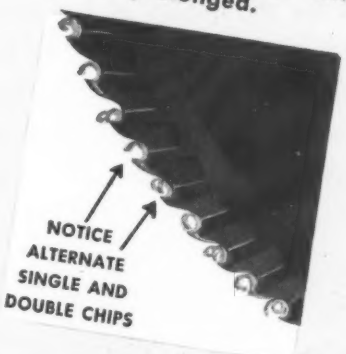
This special machine automatically cuts gates and risers from aluminum bearings and pistons.

SPECIAL, but with All the Exclusive Advantages of *Triple-Chip* Sawing!

An almost endless range of difficult requirements can be met by M & M circular cut-off machines. Special models are being built to handle practically any material, ferrous or non-ferrous; round, square or structural . . . always with Triple-Chip advantages: faster feeds and record-breaking speeds; clean, square, accurate lengths without burr; longer blade and tool life. Also, Motch & Merryweather is building special "many-in-one" models which combine cutting off with threading, center drilling, reaming, facing, chamfering and turning. Our technical staff will be glad to design a combination machine for you which will pay for itself and go on to show a handsome profit in 1949.

Triple-Chip METHOD

Teeth are ground alternately high and low with our Triple-Chip cam-generated tooth form. Narrower tooth removes center of work; broader tooth removes two remaining corners. Load is distributed, tooth strain reduced, heavier feeds made practical, blade life prolonged.



Only M & M builds ALL 3: CIRCULAR SAW · SAW BLADE · BLADE GRINDER

What, sir, are your requirements?
We will give them prompt attention.

THE MOTCH & MERRYWEATHER MACHINERY CO.
PENTON BUILDING • CLEVELAND 13, OHIO

AT YOUR COMMAND • AN UNPARALLELED EXPERIENCE IN CIRCULAR SAWING

LONDON and BIRMINGHAM

BRITISH INDUSTRIES FAIR

Britain has long been the world's greatest customer, and has led the way in the export of manufactured products. By initiative in modern research, and from experience of commerce with other nations, her industrial production has become greater and more varied than ever in history.

Renowned for the quality of her work, Britain has applied new technique to her famous industries. By enterprise in fresh markets she has achieved record deliveries, and export production still expands. To keep in touch with these developments great numbers of the world's principal buyers are making visits to Britain.

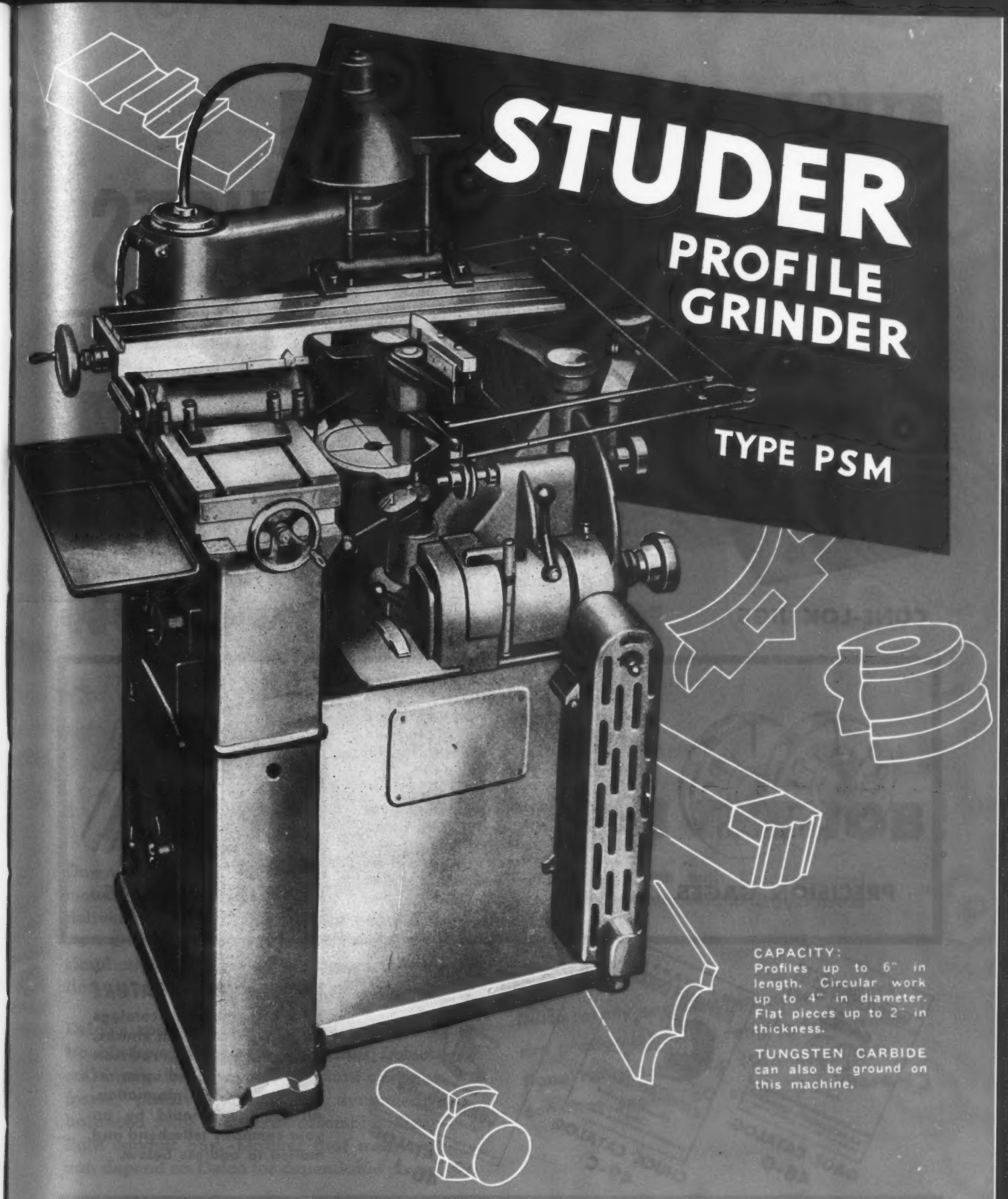
Every year, from over 100 countries, trade buyers gather at the British Industries Fair. The Chamber of Commerce in Birmingham, and manufacturers from every part of Britain, join with the British Government to welcome them.

At BIF 1949, from 2–13 May, three thousand exhibitors will display the latest developments in thirty groups of allied trades. The leading men of international commerce are invited to attend the world's greatest assembly of national products.

2-13 MAY 1949

TRADE BUYERS—PLAN YOUR VISIT NOW

Information about exhibitors, special displays and facilities at the Fair can be obtained from the nearest British Embassy, Legation or Consulate.



CAPACITY:
Profiles up to 6" in length. Circular work up to 4" in diameter. Flat pieces up to 2" in thickness.

TUNGSTEN CARBIDE can also be ground on this machine.

Get accuracy to 0.0002" on tools, gages, dies, templates and all types of small parts! The Studer Profile Grinder saves time by grinding parts complete in one operation – with one wheel, eliminates preliminary grinding to form on many small profiles. Write for complete information.

COSA CORPORATION

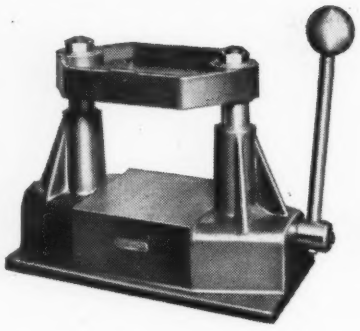
REPRESENTING STUDER IN UNITED STATES

624 Chrysler Building New York 17, New York

N. A. WOODWORTH

ENGINEERED PRODUCTS

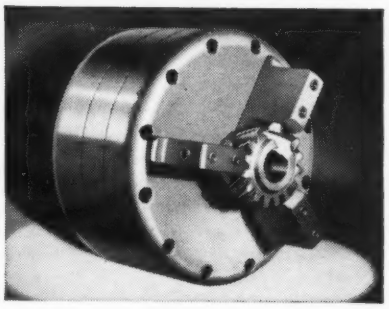
ACCURACY YOU CAN TRUST



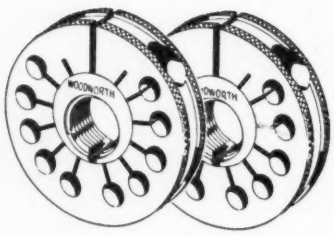
CONE-LOK JIGS

Chucks engineered and built by Woodworth guarantees the ultimate in precision gear chucking.

Woodworth Cone-Lok Jigs are noted for their mechanical simplicity and "life-time" construction.



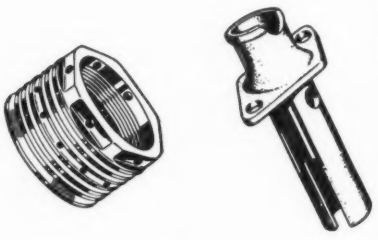
DIAPHRAGM CHUCKS



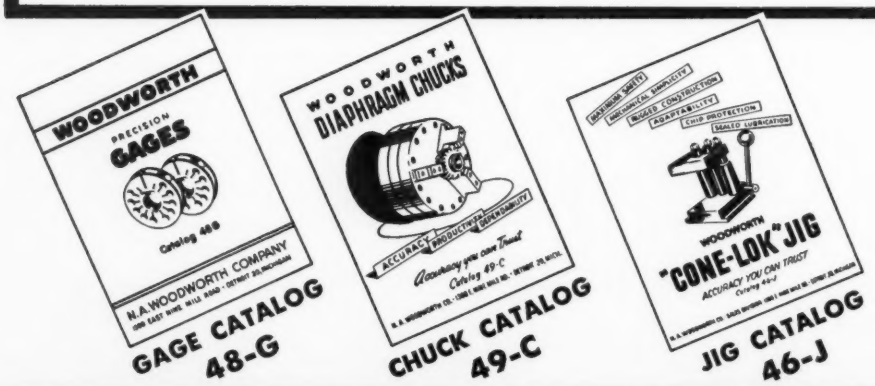
PRECISION GAGES

Woodworth manufactures a complete line of thread ring and thread plug as well as cylindrical plug and ring gages. Also produces special gages to customer blueprints.

N. A. Woodworth engineering gives you plus value in precision parts. Production men with "know-how" combined with well equipped plant are pace setters in aircraft engine and radar assembly fields.



PRECISION PARTS



GAGE CATALOG 48-G

CHUCK CATALOG 49-C

JIG CATALOG 46-J

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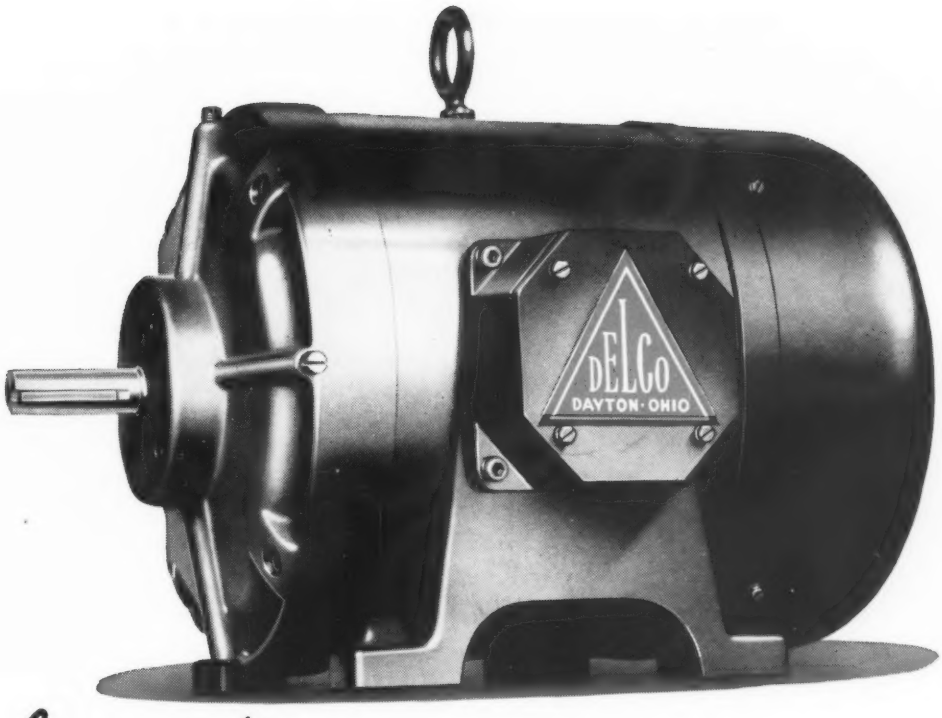

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No. 2
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Let's talk $PRICE$

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PRINCIPAL DIMENSIONS

Rated size	14"
Swing over ways	16 7/16"
Swing over cross slide	10 1/4"
Spindle bearings—Preloaded super-precision roller bearings	
Spindle nose	L-1 taper nose
Hole through spindle	1 1/2"
Range of spindle speeds	30 to 1142 R.P.M.
Carriage bearings on ways	21 1/2"
Width and length of cross slide	7"
Compound rest travel	4"
No. of thread and feed changes	48
Range of thread cutting	1 1/2 to 92

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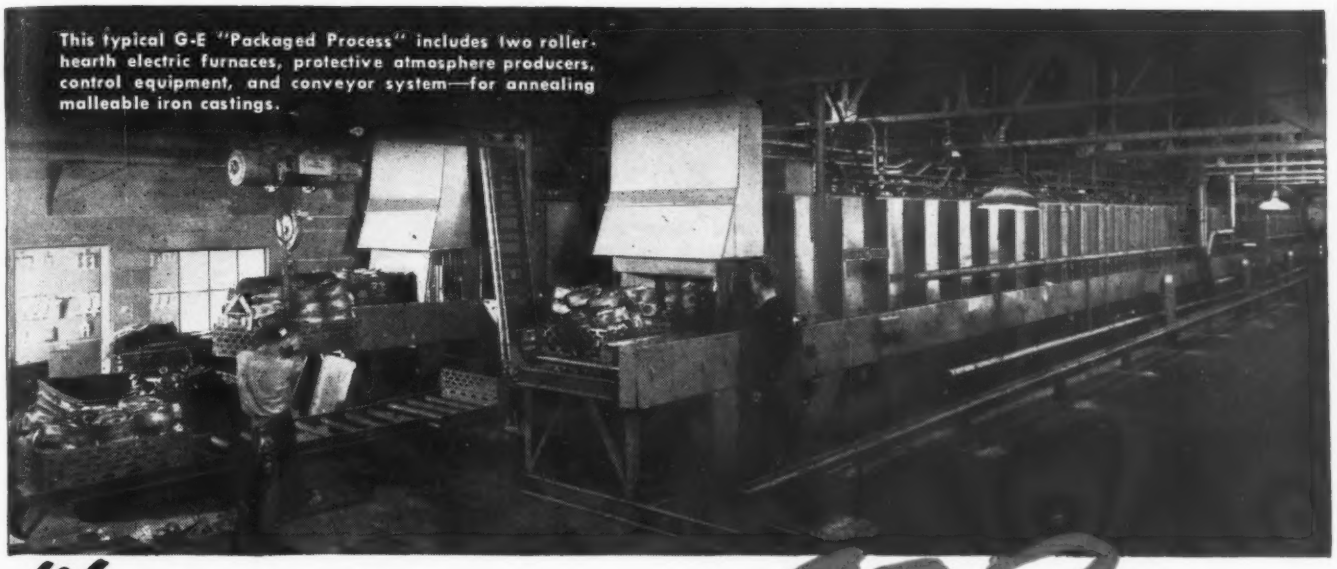

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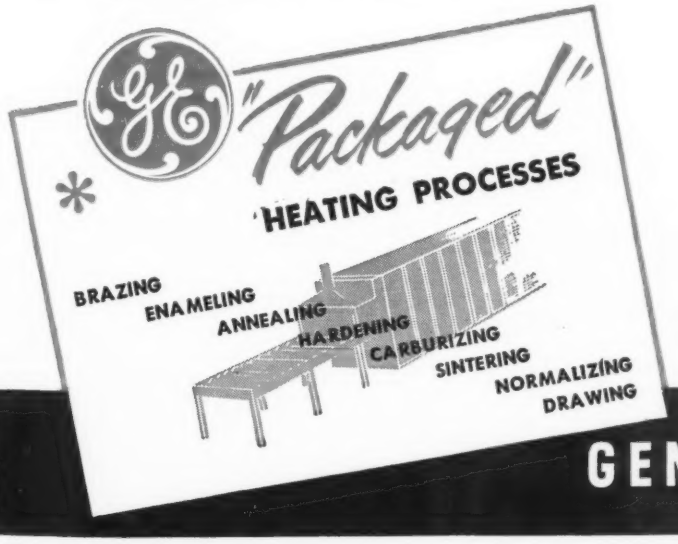

Contact the heating specialist in your nearest G-E office for additional information on G-E "Packaged" Heating Processes (or for information on electronic heaters and small heating devices); or, write *Dept. 675-177, Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

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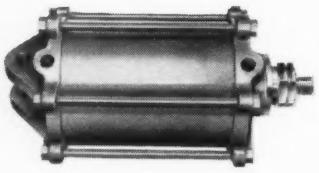
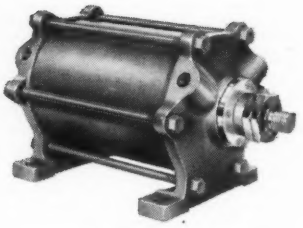
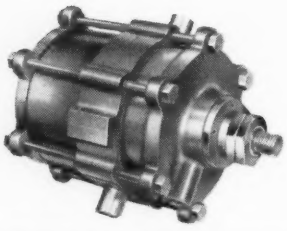


CLEVIS MOUNTING
1" to 12" Bore



FOOT MOUNTING
1" to 12" Bore



TRUNNION MOUNTING
1" to 12" Bore

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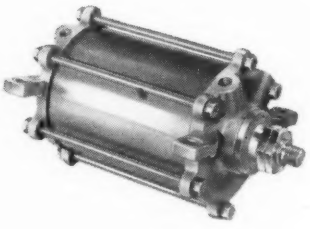

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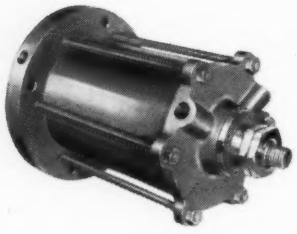
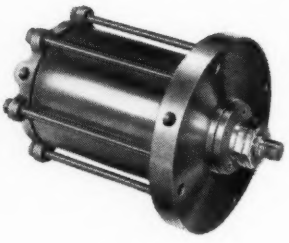
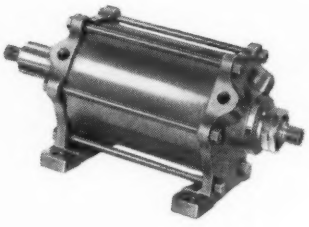
3" to 12" Bore



FLANGE MOUNTING, HEAD END
1" to 12" Bore



FLANGE MOUNTING, ROD END
1" to 12" Bore



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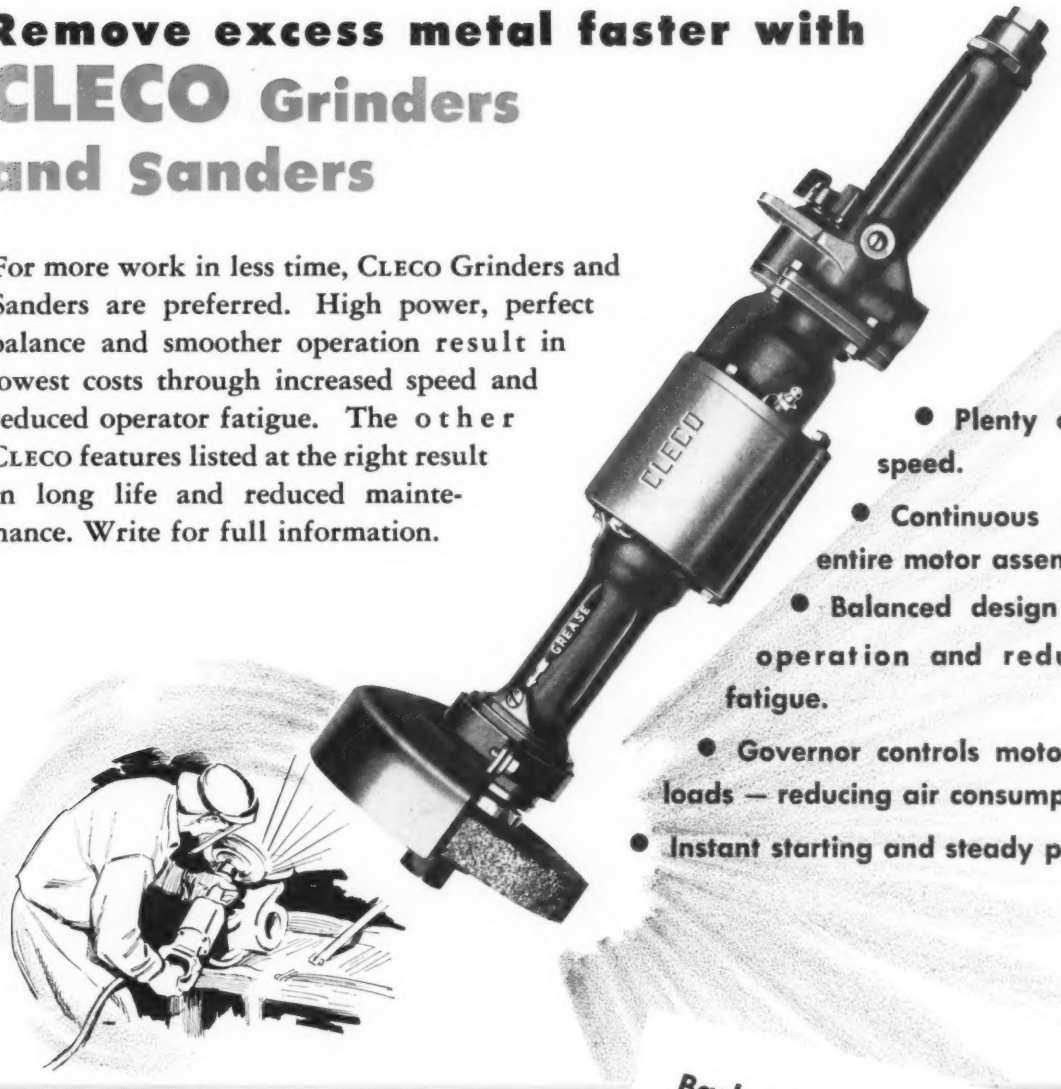
Remove excess metal faster with CLECO Grinders and Sanders

For more work in less time, CLECO Grinders and Sanders are preferred. High power, perfect balance and smoother operation result in lowest costs through increased speed and reduced operator fatigue. The other CLECO features listed at the right result in long life and reduced maintenance. Write for full information.



- **Plenty of power and speed.**
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- **Balanced design for smooth operation and reduced operator fatigue.**
- **Governor controls motor speed at all loads — reducing air consumption.**
- **Instant starting and steady power.**

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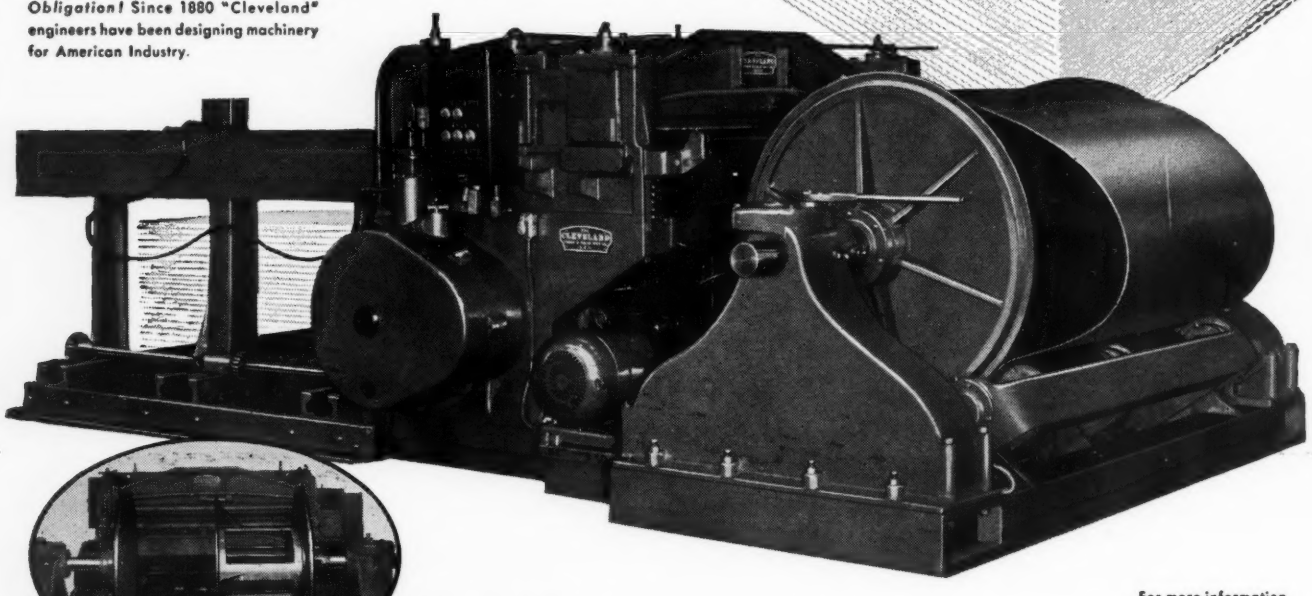
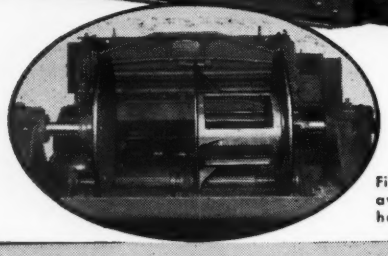
If you have special production problems, consult with our engineering staff at *No Obligation!* Since 1880 "Cleveland" engineers have been designing machinery for American Industry.





Fillers as shown at left are available for the efficient handling of narrow coils.

For more information on "Cleveland" shears or power presses, address inquires to DEPT. 5-M.

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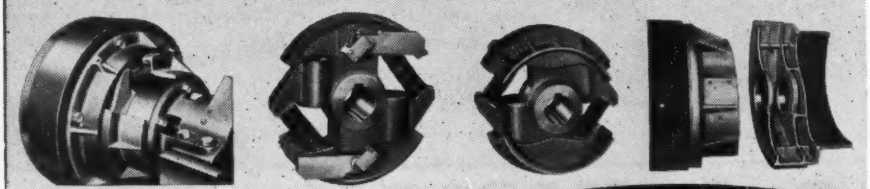

For greater power press efficiency and reduced production costs, designed to give full clutch and full break, as needed. ¼ the weight of the conventional disk friction clutch and brake, with ½ the number of parts. Now available for all types, sizes and makes of mechanical power presses.

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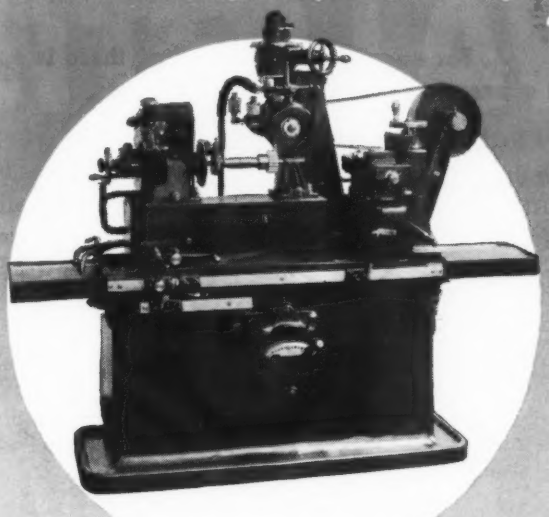
We were Proud of this GEARGRIND 30 Years Ago!



At that time it represented ten years of progress in the art of Formed Wheel Grinding, whereby gears and splines were ground *after hardening* by means of an accurately formed grinding wheel. The contour of the grinding wheel was maintained by frequent dressing, using a special Geargrind wheel trimmer.

TYPE
GG-10 x 48A

BUT PRESENT MODELS EARN *More Money for You!*

About the only resemblance between today's GEARGRIND and its predecessors is the principle involved.

On the GG-10 x 48A shown above tooth spacing is controlled by a precision ground master index plate. The work reciprocates past the grinding wheel on a *short stroke*—just long enough to clear the wheel—and at each reversal point the grinding wheel feeds down. After grinding on one tooth space until a "rough size" is reached, the work is automatically indexed and the next tooth space is ground.

After a predetermined number of teeth have been ground the dresser automatically moves into position to true the grinding wheel. Once the roughing is complete the work is finish ground in the conventional manner, indexing automatically from tooth to tooth.

This method of grinding is 3 to 4 times faster than by any previous machine of comparable capacity, and the many automatic features permit one man to operate more than one machine.

FEATURES

- Automatic grinding wheel feed
- Automatic wheel feed for trueing
- Automatically cushioned trim position
- Automatic lubrication of ways
- Double column support for grinding wheel head
- Axial grinding wheel spindle adjustment
- High work table speeds
- Control panel with interlocked safety features and highly accessible push button and other control
- Index head spindle mounted on tapered roller bearings

The GEAR GRINDING MACHINE COMPANY
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THE CAMPBELL THAT ~~CUTS~~ THE COST OF CUTTING

For every cutting operation, there is one most economical method.

For many cutting operations, this is it.

It's the new CAMPBELL MODEL 223 WET ABRASIVE CUTTING MACHINE. It is the machine especially developed for faster cutting, easier operation, longer wheel life and . . .

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It is the most widely useful Campbell Abrasive Cutter ever built.

We suggest you send for BULLETIN DH-30 that gives you complete information.

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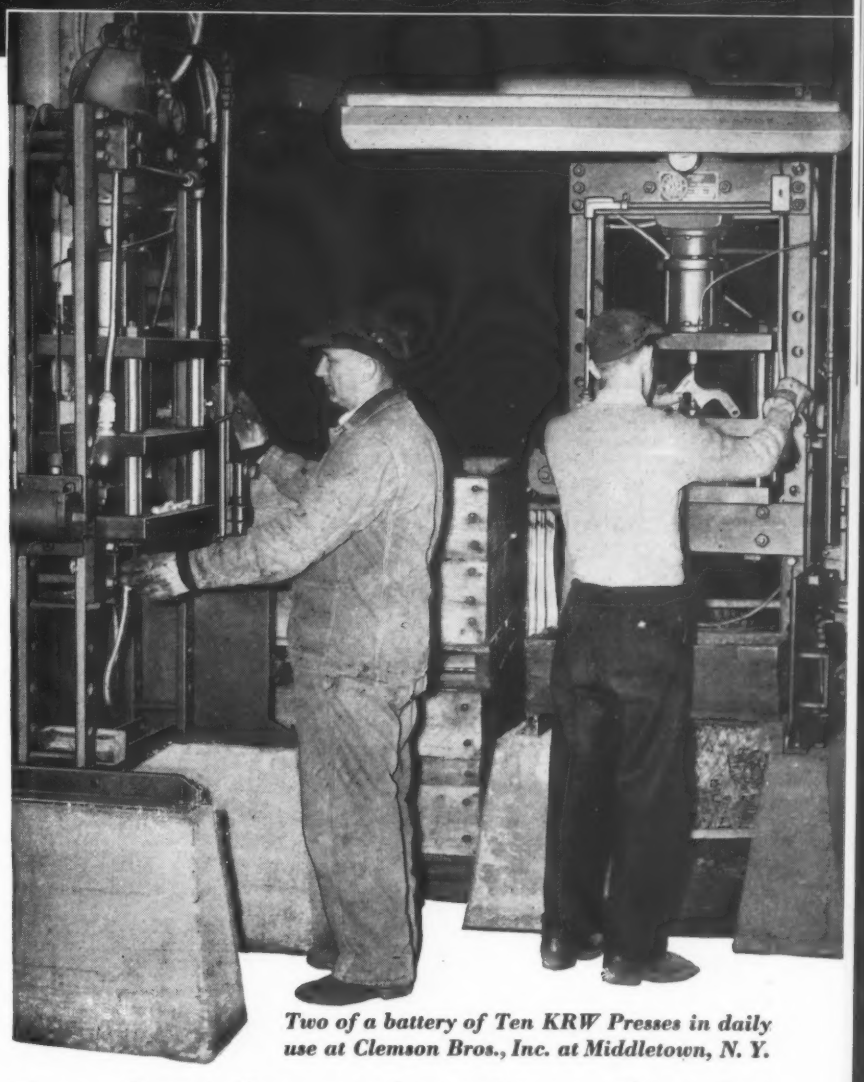
KRW PRESSES *help build* BETTER LAWN MOWERS

CLEMSON BROS., INC. USES A BATTERY OF 10 KRW 25-TON PRESSES TO BOOST PRODUCTION



Two of a battery of Ten KRW Presses in daily use at Clemson Bros., Inc. at Middletown, N. Y.

● Clemson Bros., Inc.— nationally known manufacturers of quality lawn mowers and Star Hacksaw blades and frames...utilizes a battery of ten KRW 25-ton motor-driven hydraulic presses to perform a wide variety of production operations. They say..."The use of KRW Presses in our plant has increased production." The ingenious manner in which standard low-cost KRW presses have been adapted to specific jobs by this manufacturer reflects great credit on the calibre of their production and engineering executives. KRW Presses are highly adaptable. Best proof of this can be found in the many thousands in daily use in almost every industry. They can be furnished for either vertical or horizontal ram travel. Distance between uprights can range from 1 foot to 7 feet or better. Daylight, from inches to six feet and more. This is flexibility at low-cost. KRW Press tonnages vary from 25 to 100-ton capacity. They are available either hand-operated, air-operated or motor-driven. Tell us your problem . . . we are equipped to engineer the press to the job. Mail the coupon for the facts.

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15

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A SURFACE GRINDER LIKE THIS

The most important Surface Grinder development in years!

LEACH 6X12 SURFACE GRINDER

ONLY

$485.00

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Look at that low price, then consider these facts carefully: The Leach 6 x 12 Surface Grinder actually handles 90% — yes, 90% — of the work of larger, far more expensive machines. It's a completely self-contained unit with a 2-speed ball bearing spindle, driven by a ¾ HP motor. It's accurate, time-saving, vibrationless, and proved to the hilt by hundreds of enthusiastic owners. Write to us for detailed description.

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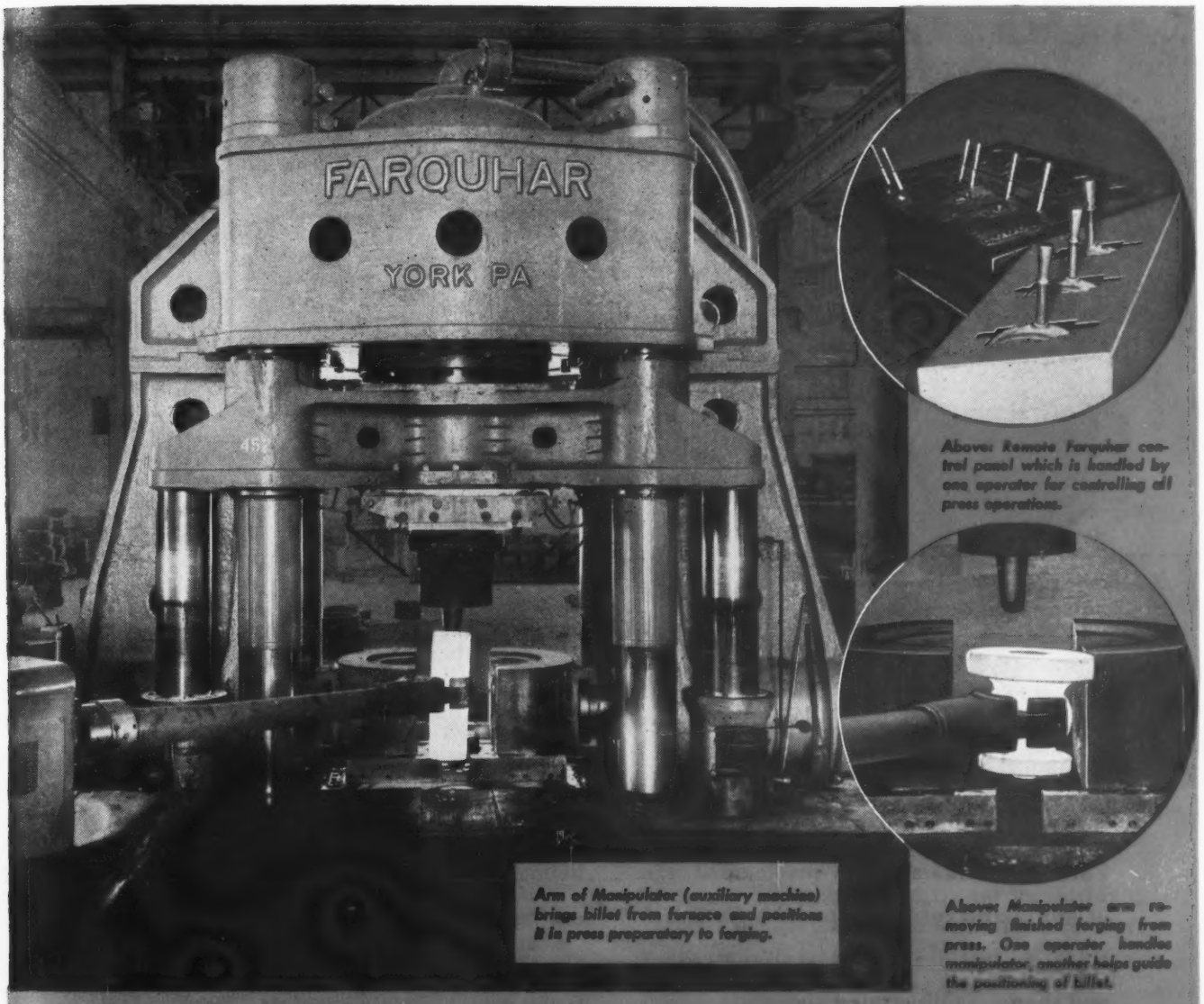

Above: Remote Farquhar control panel which is handled by one operator for controlling all press operations.

Above: Manipulator arm removing finished forging from press. One operator handles manipulator, another helps guide the positioning of billet.

Arm of Manipulator (auxiliary machine) brings billet from furnace and positions it in press preparatory to forging.

FARQUHAR HYDRAULIC PRESS

turns out better forgings *faster* for Cameron Iron Works

THIS GIANT 5000-ton Farquhar Hydraulic Press has a big job to do at the Cameron Iron Works, of Houston, Texas —*and it's doing it!*

Cameron needed faster and better production of tubing head spools which are used for well completions in the oil industry. These parts had formerly been produced from steel castings. By using the built-to-specification Farquhar Press to turn out 800-lb. forgings of the spools instead (see illustrations), Cameron speeded up production, saved time and labor.

Advantages of forgings by the Farquhar Press over the castings are: *Cheaper to produce... Forgings free from porosity ... Uniform in physical properties ... Controlled in grain structure.* And—the Farquhar Press operated at a minimum of maintenance cost. Cameron gets higher quality at lower costs for this operation—still can convert the Press for other production jobs in the future.

Farquhar Presses Cut Your Costs

Just one more example of cost-cutting Farquhar performance in heavy production. Farquhar Presses are built-for-the-job... Presses that assure *faster production* due to rapid advance and return of the ram ... *greater accuracy* because of the extra guides on moving platen ... *easy, smooth operation* with finger-tip controls ... *longer die life* due to positive control of speed and pressure on the die.

Farquhar engineers are ready to help solve whatever production problem you may have. Give them a call.

Send For Free Catalog showing the wide range of Hydraulic Presses Farquhar builds in all sizes and capacities for all types of industry. Your FREE copy is waiting. Write to: A. B. Farquhar Co., *Hydraulic Press Division,* 1504 Duke St., York, Pa.

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HYDRAULIC PRESSES

for Bending • Forming • Forcing • Straightening • Assembling • Drawing
Extruding • Juggling • Forging • and other Metal-working Operations

NO SHUTS OR FOLDS WHEN REDUCEROLLED!

Forging blanks are now pre-formed free of shuts and folds on the new National REDUCEROLL in a wide range of sizes and shapes as illustrated above.

Costly fullering and edging operations are eliminated, and the metal is distributed accurately, thus minimizing flash.

Additional advantages of REDUCEROLLING are increased production, and increased die life. The REDUCEROLL is portable, hence can be used as a "roving" tool. Low cost, quickly interchangeable rolls make short runs economical and practical. Rugged construction permits large reductions in area. REDUCEROLLING increases the range of your forging equipment ... does not require a skilled operator.

Why not let National Engineers help you investigate the application of REDUCEROLLING to your forging problems?

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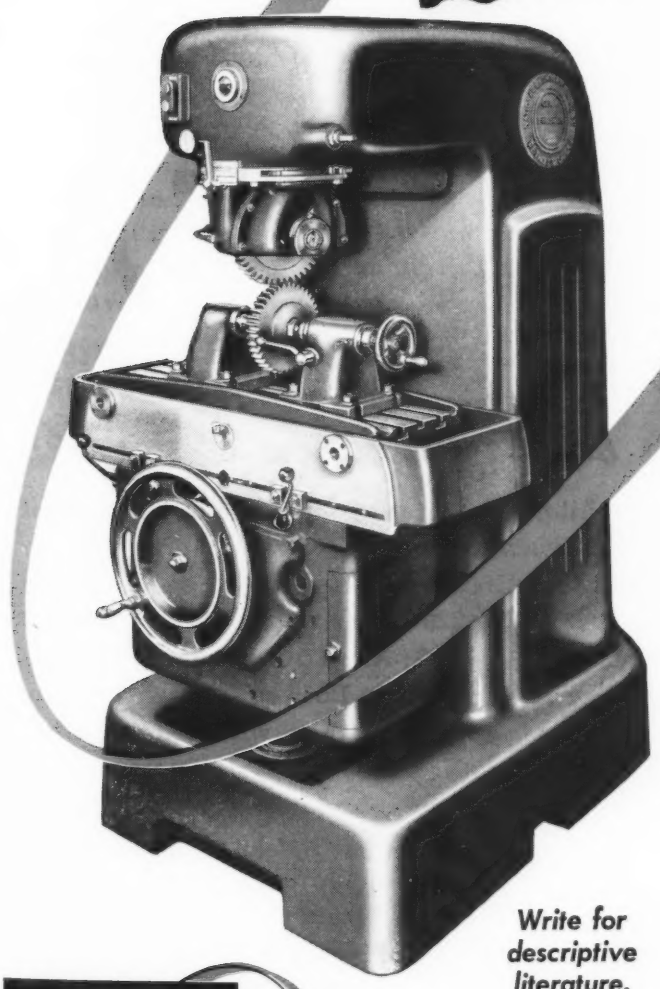


This gear shaving machine, the first of its kind, was introduced 16 years ago to fulfill the urgent need of gear manufacturers for a means of correcting precision gears and gears produced to operate under critical loads and speeds—these corrections to bring them within required tolerances.

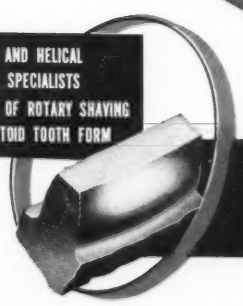
Today, it is being used by all the leading manufacturers in the automotive industry, the majority of gear jobbing shops and nearly all the machine tool builders.

One gear manufacturer says shaving has reduced rejects which formerly amounted to about 50% to none. Another says that shaved gears have cut operating power requirements approximately 20%.

Gear shaving eliminates the need for skilled machinists, regardless of the degree of precision required. Accuracy does not depend on the shaving machine operator. Shaving also makes it easier to turn out acceptable gears. The teeth of shaved gears have uniform accuracy and the characteristics of all the gears in any lot will be uniform.

Write for descriptive literature.

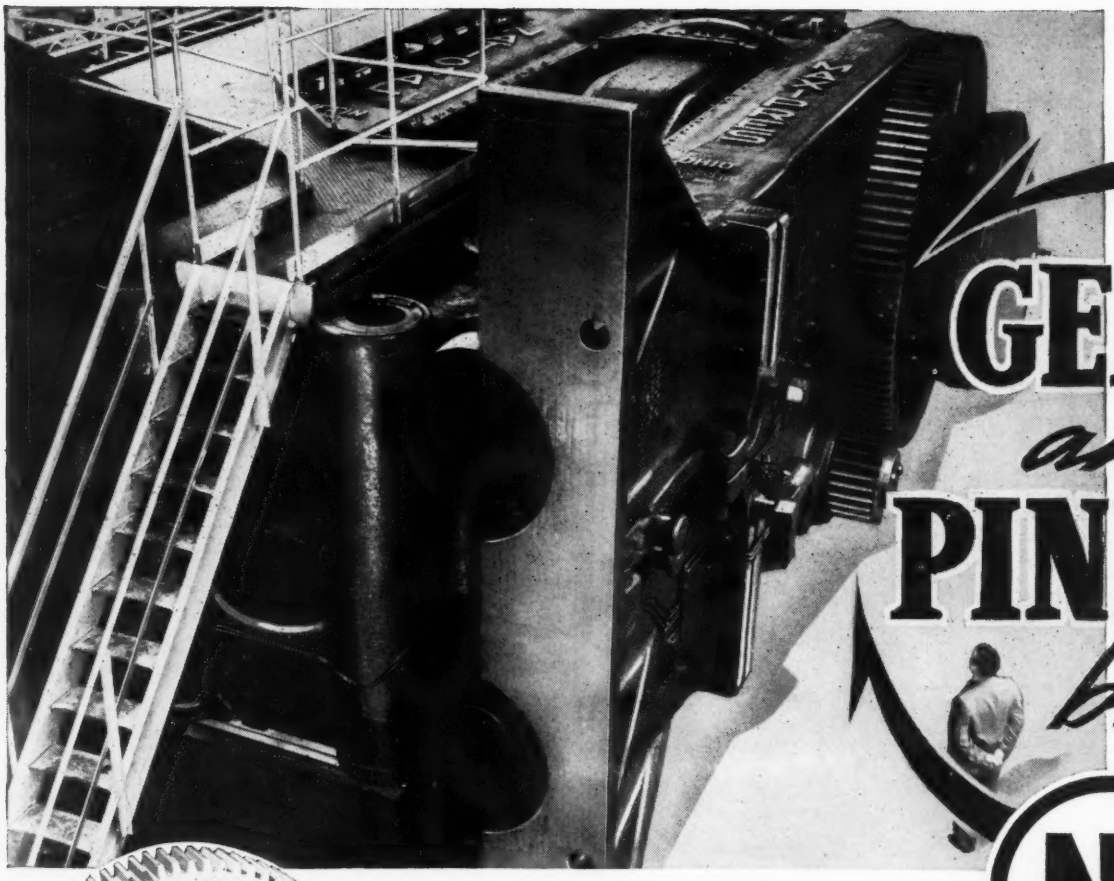
SPUR AND HELICAL
GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM



NATIONAL BROACH AND MACHINE CO.

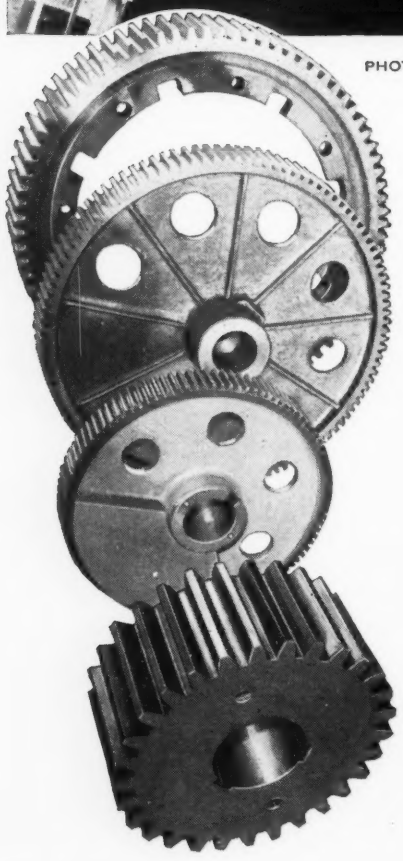
5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT



GEAR and PINION by NE

PHOTO COURTESY OF THE NATIONAL MACHINERY CO., TIFFIN, OHIO



A Press so big . . it had to be assembled on it's back!

HERE is the Neloy Alloy Cast Steel Gear and pinion drive of a No. 10 National Machinery Company Maxipres so big it had to be assembled on its back. The large gear is Neloy Molybdenum, Normalized; 190-220 Brinell rough weight 26,130 pounds. The pinion is Neloy No. 3; Alloy Steel, quenched, 202-240 Brinell rough weight 3,480 pounds. Both are 4 inch circular pitch, 16 inch face. Gearing such as this, while not routine production, is taken in stride at National-Erie Corporation where your specification requirements are completely controlled from the raw material to the finished product. Neloy or Neloy Moly, spur, bevel, mitre, Sykes Herringbone, finished gears or blanks are specialties of our Foundries and Machine Shops . . . Send your specifications to us. Bulletin No. 9 gives full details. Write for it.

NATIONAL ERIE CORPORATION

ERIE, PENNSYLVANIA • U. S. A.

ELMES HOBBING *cuts* CAVITY COSTS

Power, plus precision, plus control—that's *Elmes* hobbing presses—in sizes to 5,000 tons, and larger, for sinking hardened hobs into cold steel. It's the modern, *economical* way to produce duplicate die inserts, multi-cavities—even single-cavity molds with hard-to-make contours. Compact Elmes presses, with their rigid three-column design and sensitive control, assure precise, accurate work—whether it's one cavity, or many just alike.

EASY TO USE

Elmes hobbing presses respond quickly and unfailingly. They start at quick-closing speed; change to pressing speed automatically when the hob contacts the blank. *They can be stopped instantly.* Operators have *confidence* in Elmes presses—and that's important, for it encourages exactness, cuts rejects, saves time *and money.*

HYDRAULIC PRESSES FOR EVERY PURPOSE

Whatever your pressing problem, check with Elmes. Objective engineering, backed by *nearly a century* of successful hydraulic experience, makes Elmes presses *right* for each job—for *cutting costs* on long runs or short—for *earning profits.* Write for literature.

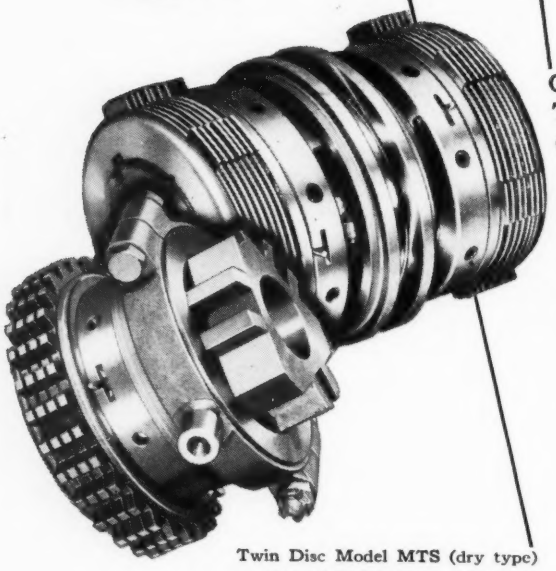
ENGINEERED BY ELMES
Good Hydraulic Production Equipment Since 1851

1500-ton Elmes hobbing press at Reinhold-Geiger, Los Angeles.

ELMES ENGINEERING WORKS *of* AMERICAN STEEL FOUNDRIES, 222 N. Morgan St., Chicago 7, Ill.
Distributors in Principal Industrial Centers • Also Manufactured in Canada

METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES

Little clutches for *Big* jobs



Twin Disc Model MTS (dry type) and Model MTU (oil type) Clutches.

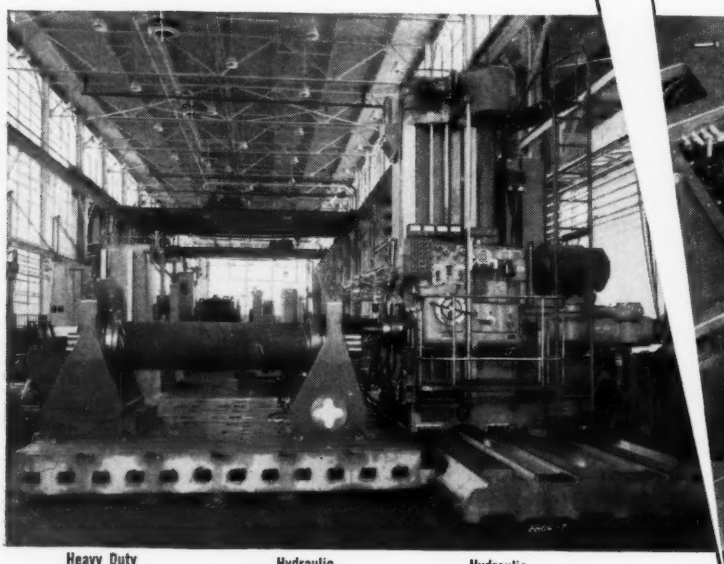
(*Left*) Producing a large steel mill roll with a Giddings and Lewis Floor-Type Horizontal Boring, Drilling and Milling Machine equipped with Twin Disc MTU Clutches. (*Right*) Two Twin Disc MTU (oil type) Clutches installed in the Giddings and Lewis Floor-Type Milling Machine.

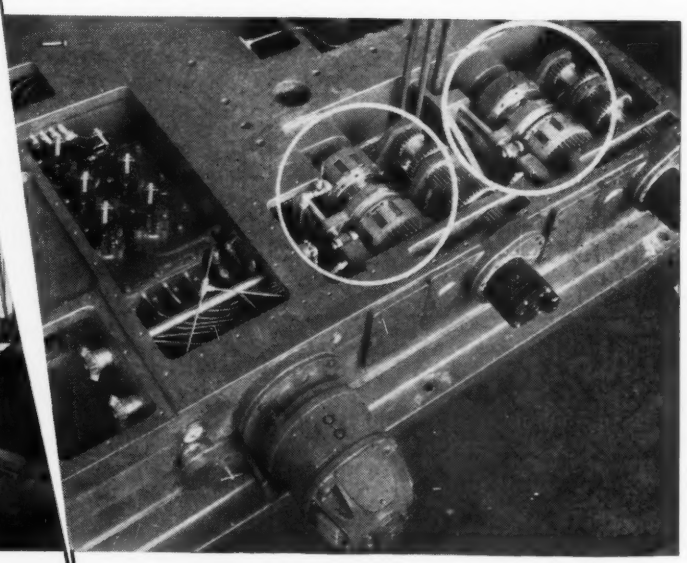
On large milling machines, as well as on small lathes, Twin Disc Machine Tool Clutches make possible easy operation, yet occupy only a small amount of space.

Models **MTU** and **MTS** Clutches, oil type, are designed for closed installations requiring a compact clutch that is small in size, high in torque capacity, and built to stand up under rapid-cycle operations. Operating mechanism is unaffected by centrifugal action and maximum efficiency is obtained when used with an oil spray.

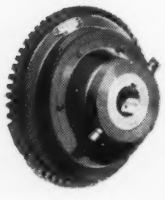
Models **MTU** and **MTS** Clutches, dry type, are also adapted to machine tools and similar mechanism that are limited in space, but where operating conditions do not call for frequent continuous cycles of engagement. High grade molded asbestos driving plates replace the phosphor bronze plates installed in the oil type clutch.

Both types of clutches provide single point adjustment in all sizes . . . both types assure greater efficiency through the relatively small number of operating parts. Twin Disc **MTU** and **MTS** Machine Tool Clutches range in size from 3″ to 9″, with working capacities from .47 to 18 hp per 100 rpm. Write for Bulletin No. 134-A. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

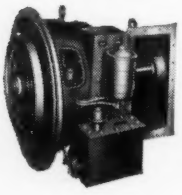




Heavy Duty Clutch



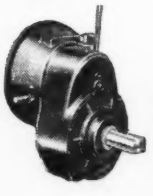
Hydraulic Torque Converter



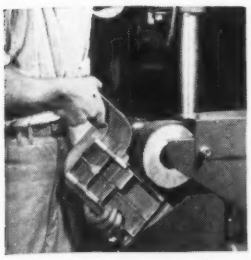
Hydraulic Coupling

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES
REG. U. S. PAT. OFF.

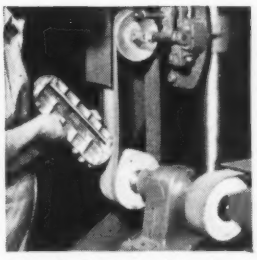
Reduction Gear



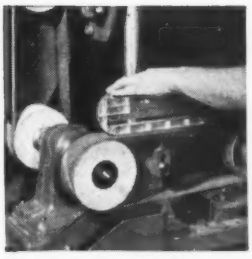
Marine Gear



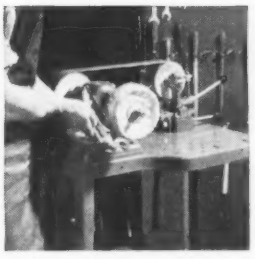
Dust chutes cause no interference with large pieces.



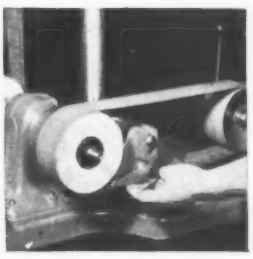
Guard raises, or swings clear, to expose any part of belt.



Platen in up-position provides flat working surface.



Easily made into a buffing machine, for many jobs.



With platen down, pieces are worked from under belt.

new!

Low cost! Portable! Takes little floor space! Does many metal-removing operations formerly requiring heavy, expensive machines!

DELTA® *Belt* Grinding, Polishing, and Deburring Machine

$130.75

without adjustable guards, dust chutes, motor, switch, or switch rod.

Price subject to change without notice.

Available in models to suit varying needs
See Bulletin AD369

Can be used to do all this—and more!

- Clean out slots
- Remove flash in corners
- Remove fins
- Smooth up crowns
- Remove nibs
- Remove parting lines
- Chamfer corners

DELTA MILWAUKEE®

You speed up flashing, grinding, cleaning, and polishing, with this new Delta *Belt* Grinding, Polishing, and Deburring Machine. You save time, labor, and material.

In this condensed unit on a welded steel stand, you get a production machine at low initial cost. With accessories to meet your particular requirements, it does hundreds of different jobs.

There are no set-up wheels to bother with; no grinding wheels to dress. Instead, you use coated abrasive belts that are inexpensive, long-wearing, quick and easy to replace.

The Delta *Belt* Grinding, Polishing, and Deburring Machine is carefully engineered for long, trouble-free service. Delta quality features assure you of that: Preloaded, lubricated-for-life ball bearings. Precision-bored bearing seats. Dynamically-balanced pulleys. All-around rugged construction. Delta Dust Collector available for use with this unit protects workers' health and expensive machinery.

Make metal-removing fast and economical. Put Delta *Belt* Grinding, Polishing, and Deburring Machines to work for you on your production line—and in your inspection department, to clean up imperfections on the spot.

Have your nearby Delta distributor show you this new machine. Send coupon for free Bulletin AD369.

Ask your distributor about easy time-payment plan!

DELTA MANUFACTURING DIVISION
ROCKWELL MANUFACTURING COMPANY
MILWAUKEE 1, WISCONSIN

Look for the name of your Delta distributor under "Tools" in the classified section of your telephone directory.

TEAR OUT COUPON AND MAIL TODAY!

DELTA MANUFACTURING DIVISION
606B E. Vienna Avenue, Milwaukee 1, Wisconsin

Send me free copy of Bulletin AD369.

Name.....

Title.....

Company.....

Address.....

City.....(.....) State.....

WM-25

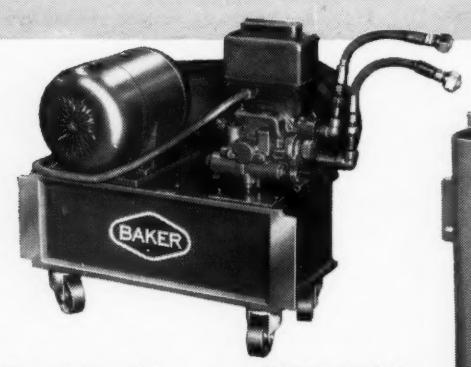
For Maximum Productivity...

New Model BAKER Hydraulic Drill

Baker Standard Model 17HO vertical hydraulic feed drilling machine is designed to afford a variety of spindle speeds, and is adaptable to single or multiple spindle operations. Other features include: pick-off gears providing spindle speeds from 40 to 1575 RPM . . . ample sump in base for coolant . . . 2″ diameter high speed twist drill capacity in SAE 1035 steel . . . saddle feed through 3¼″ diameter cylinder . . . geared head mounted on saddle . . . 13″ width of hardened steel ways, 16″ length of travel.

The machine is illustrated with 30″ diameter standard automatic indexing table. This machine can also be supplied with hand operated index tables, or non-indexing adjustable height table.

For more information write for Baker circular number 69216.



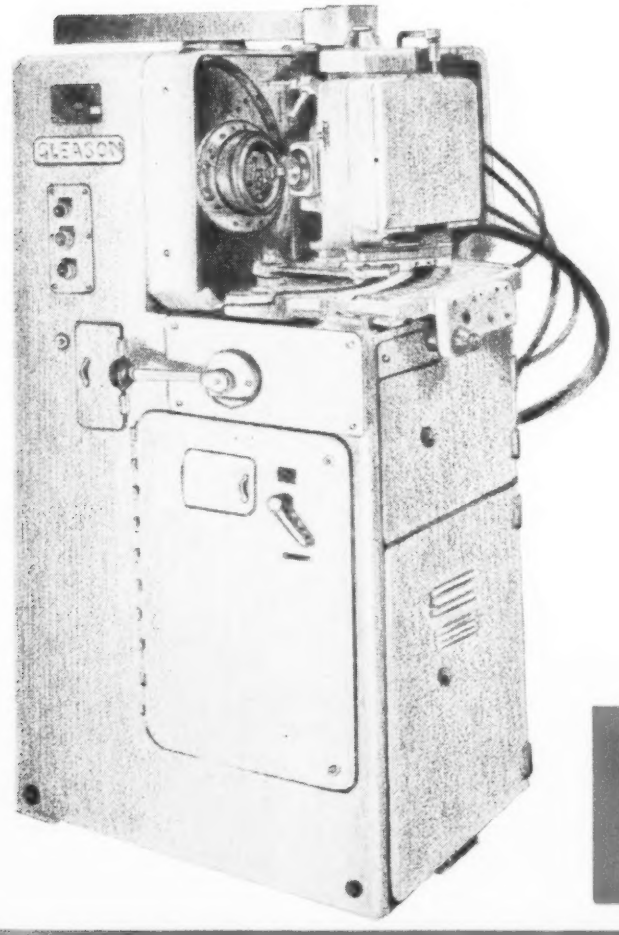
For Versatility . . . BAKER Mobile Power Unit . . . Separate variable delivery mobile pump-sump unit mounted to rear of machine and illustrated above, provides hydraulic feeding power. The unit is mounted on casters and is connected to the machine by two self-sealing couplings designed to permit a fast exchange of hydraulic power units without influx of air into the hydraulic system. Units may be switched with negligible loss of production time.

BAKER BROTHERS, INC., Toledo, Ohio
DRILLING, TAPPING, KEYSEATING and CONTOUR GRINDING MACHINES

A GEAR CUTTING GENERATOR FOR THE SMALL BEVEL GEAR FIELD

GLEASON *No. 2 Hypoid Generator*

SPIRAL BEVEL
ZEROL BEVEL
&
HYPOID GEARS



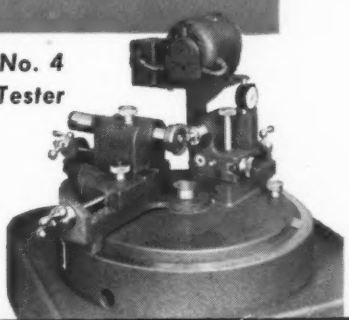
The latest addition to the small gear cutting field (for gears of 16 D.P. and finer) for production or jobbing is the new Gleason No. 2 Hypoid Generator. Closer control of actual cutting is provided on this machine, thereby making possible faster cutting time and a superior tooth bearing, accurately located. In most cases generated gears can be completed from the solid in one operation. In addition, this machine will produce curvic clutches and couplings and high reduction hypoid gears.

Additional equipment necessary to the smooth production of bevel gears and hypoids is the Gleason No. 7 Hypoid Cutter Sharpener which produces a high quality cutting edge and finish on the multi-blade circular cutters used on the No. 2 Hypoid Generators.

Gleason No. 7 Hypoid Cutter Sharpener

The No. 4 Angular Bevel Tester is employed to check the rolling qualities, tooth spacing and concentricity of small fine pitch bevel gears such as those cut on the No. 2 Hypoid Generator.

Gleason No. 4 Angular Bevel Tester



GLEASON *Works*
1000 University Avenue
Rochester 3, N. Y., U. S. A.

Builders of Bevel Gear Machinery for Over Eighty Years

UNIVERSAL

marches at the head of the drill bushing parade!

super finish reduces wear to a minimum

blended radius banishes tool hang-up

100% hardness and concentricity tests assure accuracy

knurled head provides quick sure grip

ample stocks in 3 warehouses assure immediate delivery

The main office at Frankenmuth, Michigan, and Universal warehouses at 89 Main St., Ansonia, Conn., and 5035 Sixth Ave., Kenosha, Wisc., offer prompt delivery.

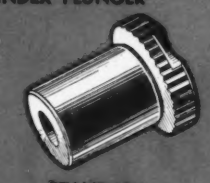
UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH 2, MICHIGAN

OTHER UNIVERSAL PRODUCTION TOOLS

BORING CHUCK

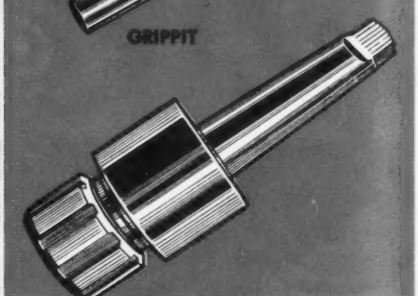
MIKRO-LOK BORING BAR

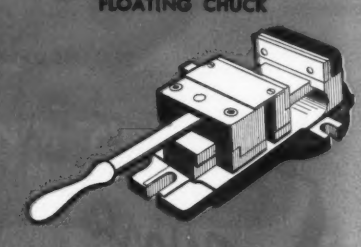
INDEX PLUNGER


STANDARD DRILL BUSHING

STANDARD COLLET CHUCK

GRIPPIT

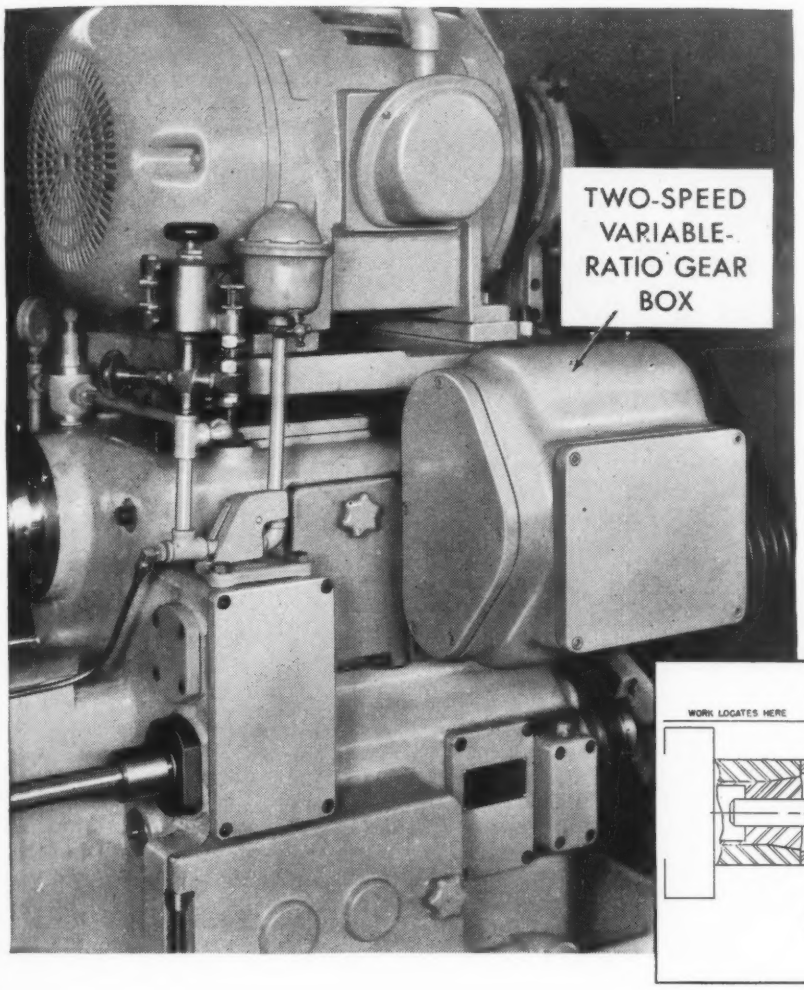

FLOATING CHUCK


WEDGE-LOCK PRODUCTION VISE

Facilities Available for Special Hardened and Ground Precision Parts Made to Customer Specifications

MACHINE OF THE MONTH

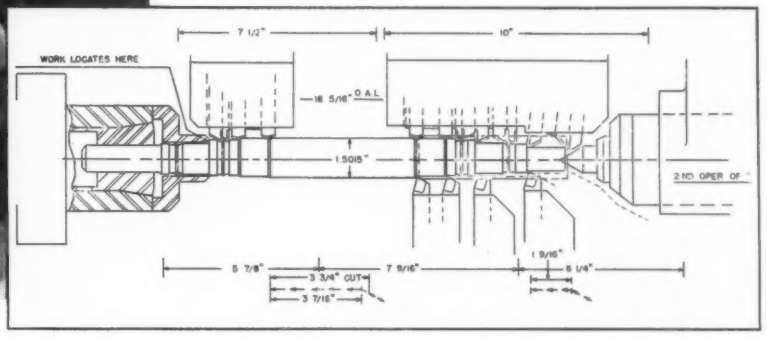
PREPARED BY THE SENECA FALLS MACHINE CO. **"THE Lo-swing PEOPLE"** SENECA FALLS, NEW YORK



Combined Turning and Squaring Operations at Different Cutting Speeds Now Possible with Lo-swing Automatically Controlled Two-Speed Headstock

Left. View of two-speed, Variable-Ratio Gear Box with Belt Guards removed.

Below. Tooling layout for electric motor shaft.



Problem: To turn, face and undercut shoulders on electric motor shafts, using cemented carbide tools for the turning operations and high speed steel tools for facing, grooving and chamfering operations which require a very smooth finish. Both operations to be made in one handling with automatic spindle speed change between the turning and squaring operations.

Solution: The Model "LR" Automatic Lo-swing Lathe selected for this job was equipped with a Two-Speed, Variable-Ratio, Gear Box shown in the illustration. The speed change from high to low and back to high again in a single machine cycle is controlled by two adjustable cams, mounted on the main cam shaft, which may be set to operate the multiple disc clutch at any time during the machine cycle. The ratio between the high and low speeds may be modified through pick-off gears to suit special conditions without removing or dismantling the gear box.

The tooling layout shows the second of two operations on a 1½″ diameter electric motor shaft. The shaft is held and driven, on a previously turned diameter, in an air-operated collet chuck which grips the shaft well in from the end, exposing only the part to be machined. This method reduces the shaft's effective length and eliminates springing due to the rigid grip of the collet. The work is positively located from a previously finished shoulder, insuring accuracy of shoulder lengths.

The shaft diameters are turned with sintered carbide tools mounted on the front carriage, cutting at a surface speed of 350 ft. per minute. The squaring and forming tools are mounted on the rear slide and operate at a surface speed of 70 ft. per minute, insuring a very high polished surface on the shoulders and formed grooves. This combination assures high production, coupled with smoothly finished shoulders, both of which are very desirable on electric motor shafts.

Consult Seneca Falls engineers for assistance in solving your automatic turning problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

PRECISION • EXPERIENCE • DEPENDABILITY

ALLIED CORPORATION PRODUCTS

When "unimportant" jobs in a manufacturing plant are regarded as of no significance, important operations can very well be seriously affected. That is why at Allied *every* job is important and is entrusted to capable hands. The "end result" is a product that has received careful attention in every department—that in every way reflects Precision, Experience, Dependability.

ALLIED PRODUCTS CORPORATION
DEPARTMENT 44
4608 LAWTON AVENUE • DETROIT 8, MICHIGAN

HARDENED AND PRECISION GROUND PARTS • STANDARD CAP SCREWS • SPECIAL COLD FORGED PARTS
SHEET METAL DIES FROM THE LARGEST TO THE SMALLEST • JIGS • FIXTURES • STEAM-HEATED PLASTIC MOLDS • SPECIAL PRODUCTION TOOLS • R-B INTERCHANGEABLE PUNCHES AND DIES • DIE MAKERS' SUPPLIES

Locating to close tolerances—2 case studies

Automatic drilling and tapping machines cut costs by locating operations accurately and increasing output per man-hour

Dear Sir:

Automatic drilling and tapping machines locate operations to close tolerances in production because:

All tools operate on the part in the same chucking.

Bushings guide drills and reamers. Bushing plates pilot to the fixtures.

Spindles are located to exact indicator readings.

Automatic unvarying cycles make all parts uniform.

Cost is low when output is high

Notice how low the costs are: 15c for the cam with 56 operations; 2-3/10c for the brake cylinder with 11 operations. These costs include both man and machine on this basis: (1) the current average national wage rate, (2) 80% efficiency, and (3) the machine paid for after only 6000 hours, a fraction of its profitable life. No power or overhead.

Cost is low when a Kingsbury does many operations each hour. Reduce output and naturally unit cost goes up. Sometimes this makes a Kingsbury uneconomical. But if accurate location is a problem, it may still be the best solution. That reminds us of a story.

An expert is surprised

A man who knew our machines saw us one day during the war. "I always thought Kingsburys were high production machines."

"You are 98% right," we said.

"Well then, I just saw some of that other 2%," he said. "An aircraft plant I just visited has a line of 11 Kingsburys. Only one machine was running at a time. Fellow would put one lot of cylinder heads through a machine, shut it off, take the truck load to the next machine and do the same thing there."

"Locating to close tol—," we began.

"Oh, sure, sure, sure," he said. "I realized that right off. After I looked at the job I would hate to do it any other way. Fellows there are tickled to death with their Kingsburys. Said they had several lines of them."

"Indeed they have," we said. "Just ask us to figure a compound angle. We have done so many of these machines we are old hands at compound angles. But at first we had to have 10 engineers figure them. When 2 of them agreed we started with their figures and went on from there."

We admit this application is unusual. We even admit (reluctantly) that there are other ways to drill and tap to close tolerances in production. But we do feel that our proposals for this work merit your serious consideration.

For many high production jobs

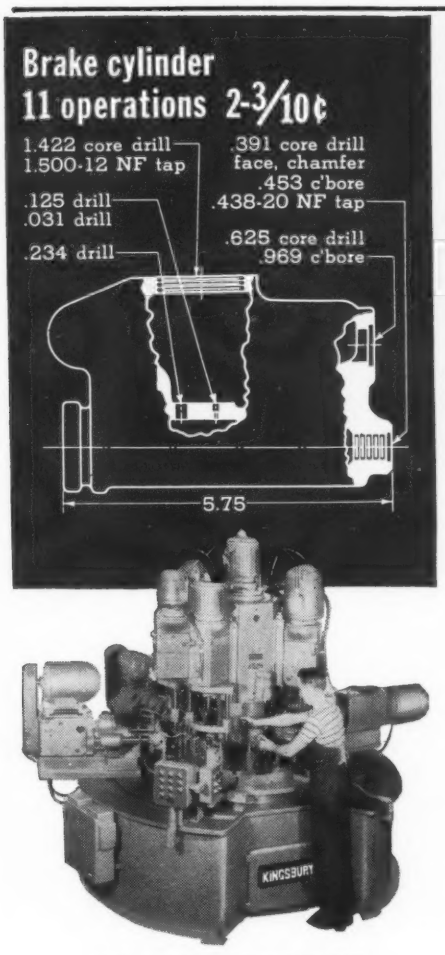
Locating to close tolerances is an important advantage with a Kingsbury. But low cost on high production work is still the main reason for using them. We can make efficient setups for many different jobs — simple or complex, with small or medium operations. (Note the brake cylinder with .031 drill and 1.422 core drill in the same chucking.) Here is why: We can choose from a complete line of standard drilling, tapping and indexing units and attachments. We have designed, built and tooled over 3,500 machines. It is our sole business.

Can we make you a proposal for a tooled machine? Just send a print to our Mr. L. A. Carll. Tell him the operations and hourly output you need. It is worth a few minutes to get the facts.

Sincerely,

Kingsbury Machine Tool Corp.
60 Laurel St., Keene, N.H.

P.S. Free bulletins showing 40 setups are yours for the asking. Please use your company letterhead.

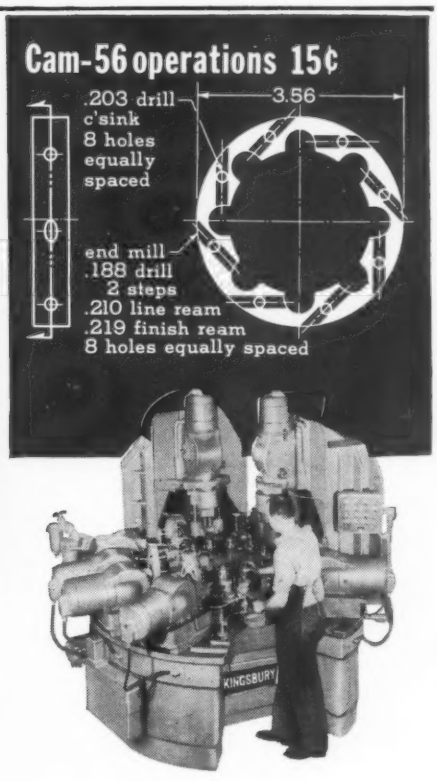


360 PARTS AN HOUR GROSS

To locate every operation exactly, bushings guide every tool except the taps. A ball bearing bushing guides the 1.422 core drill. Other bushings are plain. All bushing plates plug into the fixture or the part itself.

• Ten units operate in turn on each part. The base supports 4 horizontal units, the central column 6 vertical units. Every tool is in easy reach because the working area is not caged in.

• Note the range of operations. A 1.422 core drill (5 hp) and a .031 drill (½ hp) operate in the same chucking.



49 PARTS AN HOUR GROSS

This is one of 10 Kingsburys that an automobile plant uses on related high production jobs to locate accurately peripheral holes inclined at a 40° angle to the surface.

• Bushings in piloted plates guide 3 of the 5 tools for each peripheral hole. The sequence: end mill (guided), drill first step (guided), drill through, line ream (guided) and finish ream. Drilling in 2 steps maintains required output by keeping the time cycle down.

• Each part passes around the machine 4 times. After the 1st, 2nd and 3rd passes, the operator rotates each fixture 90°. Each time around, 2 vertical units with 2-spindle auxiliary heads operate on two .203 holes, and 10 horizontal units operate on 2 adjacent peripheral holes. Five horizontal units are 22½° left of the radial line, 5 are 22½° right.

85

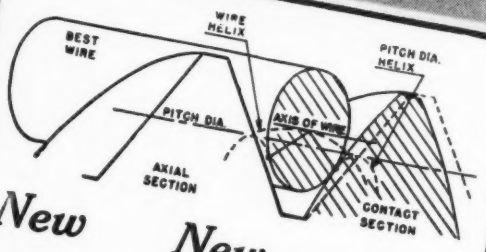
KINGSBURY

AUTOMATIC DRILLING
AND TAPPING MACHINES
for Low-Cost High Production

Van Keuren MEASURING WIRES

STANDARD EQUIPMENT... ...everywhere

Measuring the pitch diameter of a 1"-8 National Form thread gage. This method is recommended by the Bureau of Standards.



New New New

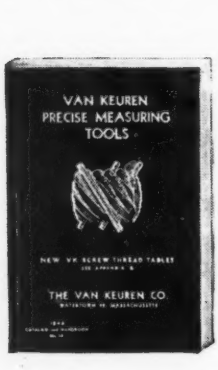
- **NEW CONCEPTIONS**
- **NEW FORMULAS**
- **NEW TABLES**

for the exact measurement of multiple worms and screws of unknown profile.

The Fundamental Fact

The axis of a wire resting in a thread assumes a position tangent to the helix passed through the center of the wire and not the point of contact.

Van Keuren Measuring Wires are the accepted standard equipment for making pitch diameter measurements of taps, thread gages, precision threaded parts, hobs, worms, splines and gears. Reputable manufacturers of ground taps and thread gages used for the production and acceptance of threaded holes and nuts use Van Keuren Measuring Wires. You will seldom find them in error if you, too, have Van Keuren Measuring Wires.



CATALOG AND HANDBOOK NO. 34

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

Copies are free upon request.

Set No. 20 Thread Measuring Wires is a plant necessity for maintaining taps and thread gages within their limits for wear and for proving the pitch diameter of screws and threaded parts.

Price, High Speed Steel Wires....$ 95.00
Price, Carboloy Wires..... 240.00

Special wires from .002" to 2.000" diameter are made to any tolerance required.

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30th YEAR

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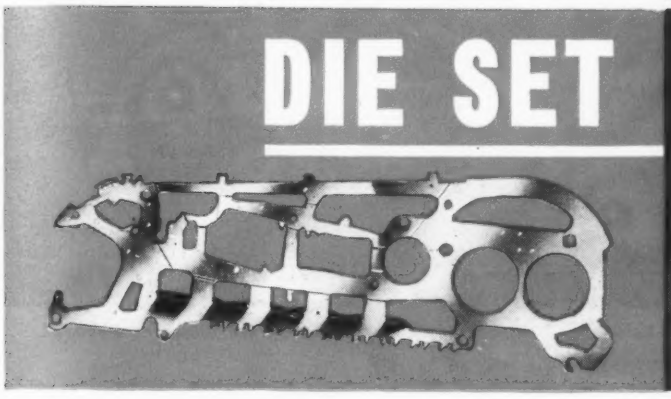
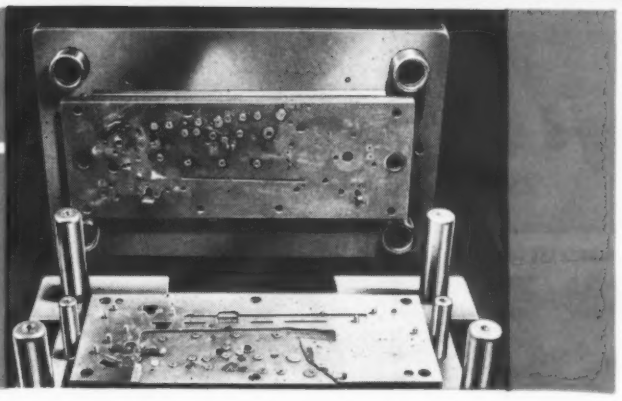
Precision stampings at Felt & Tarrant speed assembly of Comptometers

tolerances of 0.0005" held on 65 holes

. . . using DANLY PRECISION DIE SET





produces 23,000 steel stampings per grind

Here is a Danly Precision Die Set employed by Felt & Tarrant Mfg. Co. of Chicago to produce frame plates for Comptometers—high-speed adding-calculating machines.

The die illustrated is mounted on a four-post Danly Standard Semi-Steel Precision Set. It trims, pierces, and notches 65 holes in .035 cold rolled strip steel. The work-piece is hand fed and positioned on dowel pins. A two-post stripper is used to prevent distortion. Production averages 23,000 pieces between grinds. Typical of other stampings produced for Comptometers with Danly Die Sets, tolerance of .0005" on each hole is maintained which speeds assembly line work and permits complete interchangeability of parts.

Here again is evidence of the inherent accuracy of Danly Precision Die Sets under actual press operating conditions. Built to precision tolerances (guide posts and bushings ground to limits of .0002") they permit taking full advantage of the die maker's precision, help you hold close tolerances and get longer tool life.

Danly has a wide range of standard stock sizes available which can be quickly assembled and delivered to help you save time and money.

Danly Engineering Service
Consult our engineering department for helpful recommendations on die sets—large or small, standard or special—*for any type of press operation.*

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Danly offices in 10 key cities give immediate attention to your orders. Assembly plants (marked with stars) stock interchangeable parts for quick assembly and delivery of any standard die set to your specifications.

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- ★ **Cleveland 14,** 1550 E. 33rd St.
- ★ **Dayton 2,** 990 E. Monument Ave.
- ★ **Detroit 16,** 1549 Temple Ave.
- ★ **Grand Rapids,** 113 Michigan Ave., N. W.
- ★ **Long Island City 1,** 47-28 37th St.
- ★ **Los Angeles 54,** Ducommun Metals & Supply Co., 4890 S. Alameda
- ● **Milwaukee 2,** 111 E. Wisconsin Ave.
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Illustrates how Danly Service on special die sets can save you time and money.

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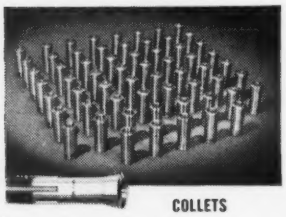
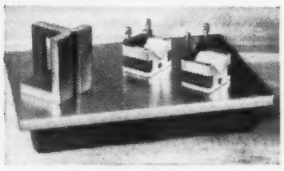
PRECISION DIE SETS...STANDARD AND SPECIAL | MECHANICAL PRESSES AND PRESS EQUIPMENT

SOUTH BEND 9" LATHE

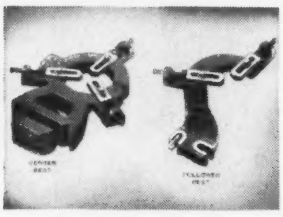
TOOLS AND ATTACHMENTS



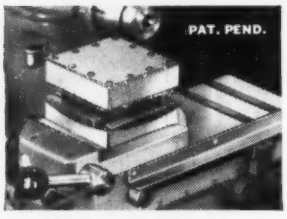
COLLETS



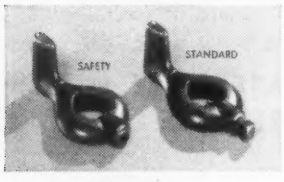
SURFACE PLATE, ANGLE PLATE, V-BLOCKS



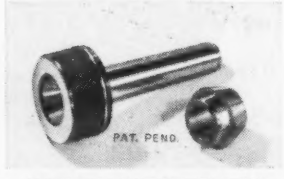
FOLLOWER AND CENTER RESTS



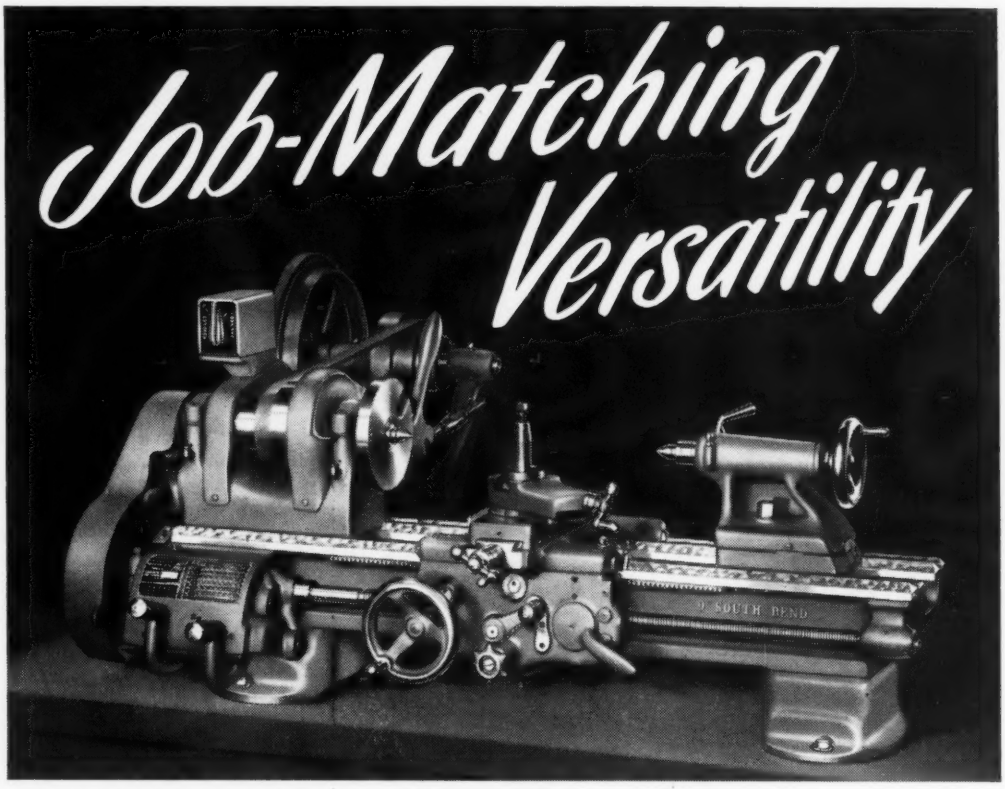
SQUARE TURRET TOOL BLOCK



LATHE DOGS

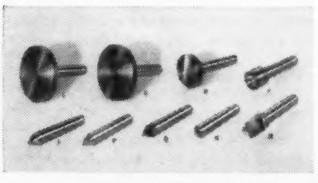


ADJUSTABLE COLLET BUSHING CHUCK

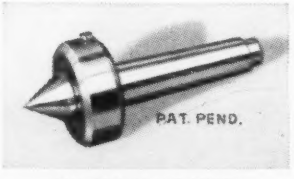


9" x 3' Model A 12-speed Bench Lathe with 3 ph., 220 V., motor and switch, f. o. b. factory — **$335.45**

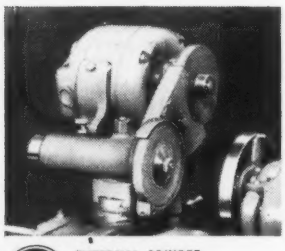
Here's a lathe that cuts your machining costs on small precision parts. Its wide ranges of speeds, power feeds and thread cutting feeds provide versatility that meets the requirements of practically every job. Add to this versatility with the numerous job-simplifying attachments and the scope of its work is even greater. This enables you to better match the lathe to your jobs. It results in faster operations, greater accuracy, quicker set-ups, lower tooling-up costs, and the release of heavier machines for heavier work. Write for catalog or call our distributor whose name and address are listed under "Machine Tools" in your classified telephone directory.



CENTERS AND DRILL PADS

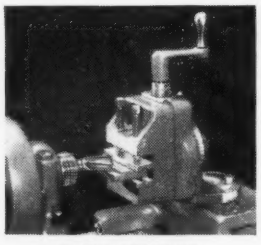


BALL BEARING LIVE CENTER

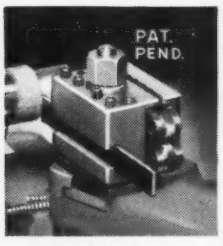


EXTERNAL GRINDER

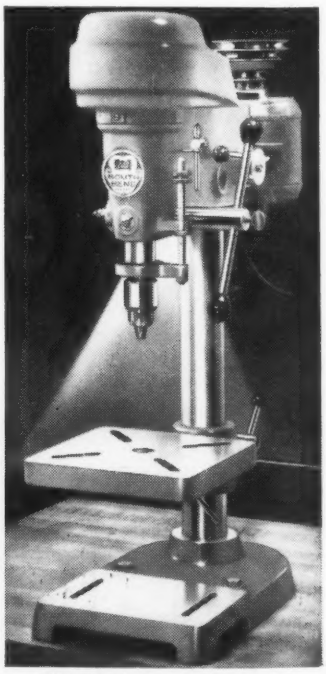
COOLANT PUMP



MILLING ATTACHMENT



UNIVERSAL TOOL BLOCK



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COMPLETE INSURANCE

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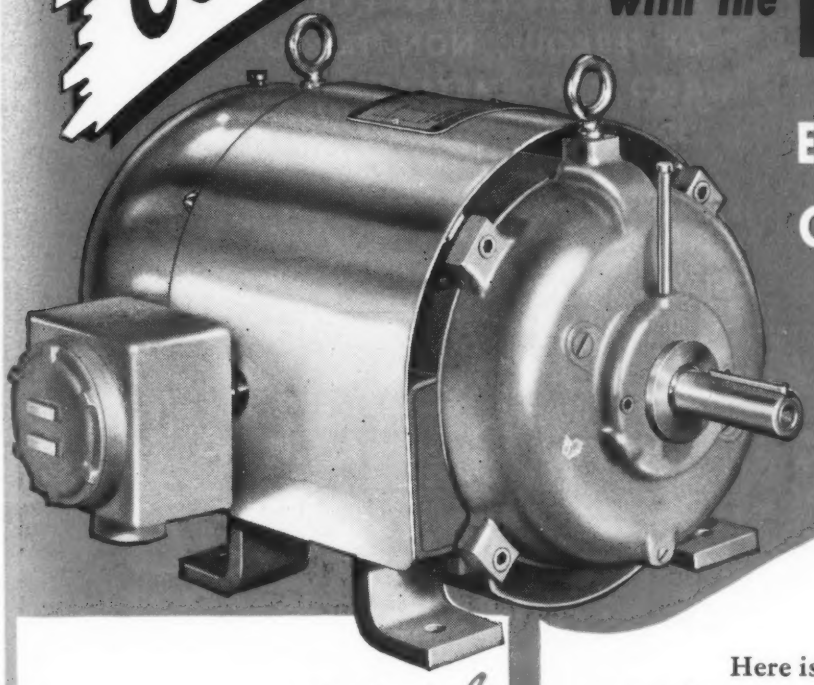

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FOR CORROSIVE ATMOSPHERES

The Totally-Enclosed Fan Cooled A-c. Motor for Applications where Chemical Atmospheres Prevail

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FOR ATMOSPHERES CONTAINING HAZARDOUS GAS OR INFLAMMABLE LIQUIDS

Underwriters' Class 1, Group D Explosion-Proof A-C. Motor

Here is the result of Reliance engineering applied to the problem of protecting motors that operate in either corrosive or explosive atmospheres. Frame and fan covers, fan, conduit box and end brackets are all made of selected corrosion-resisting materials. In addition, many extra steps are taken to achieve maximum protection, such as coating screws, counterboring screw holes and fitting-up with special compounds.

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A SELF-CONTAINED OIL-HYDRAULIC MACHINE FOR HANDLING PLATES OF FERROUS, NON-FERROUS AND CLAD METALS UP TO 132" WIDTH AND 31 FT. LENGTH

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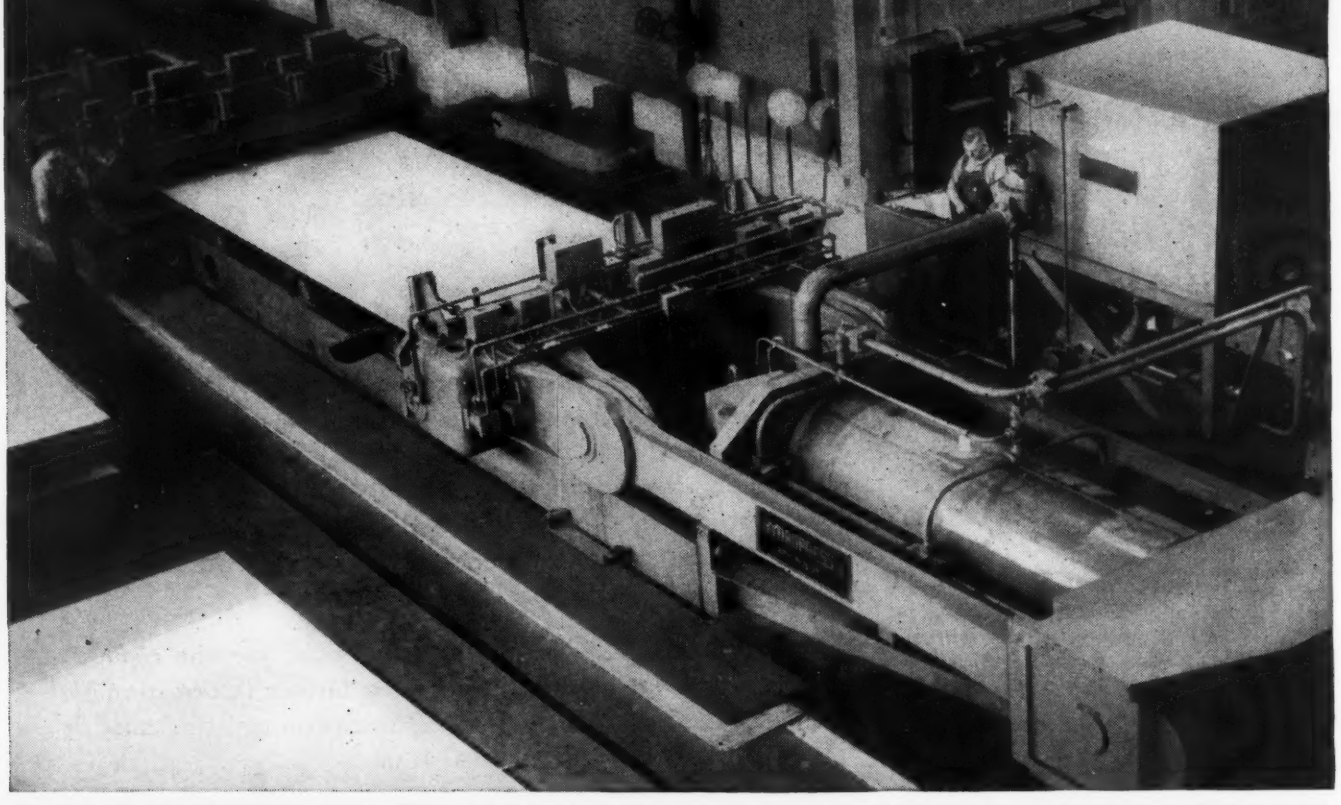

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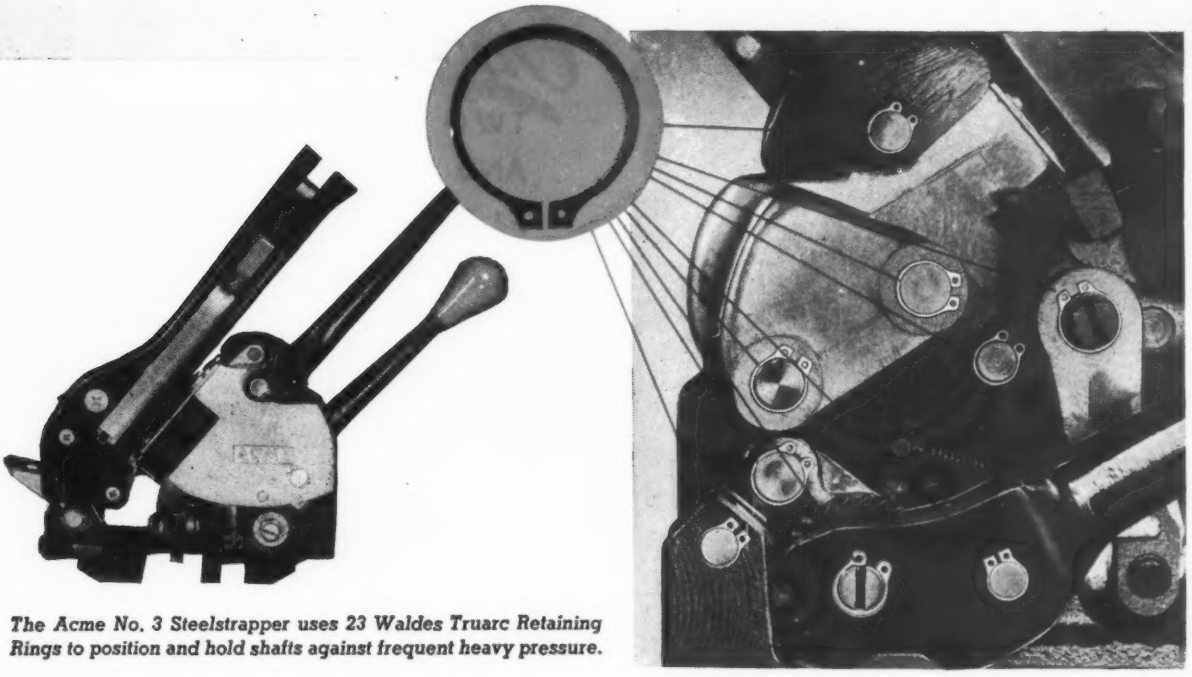
23 Truarc rings permit changeover to centerless grinding savings



The Acme No. 3 Steelstrapper uses 23 Waldes Truarc Retaining Rings to position and hold shafts against frequent heavy pressure.

"The use of Truarc Retaining Rings permits centerless grinding of pins instead of plunge-grinding. This eliminates the problem of taper and reduces the required tensional tolerances of these parts," reports Acme Steel Company of Chicago. "Furthermore, use of Truarc rings gives the Steelstrapper smoother lines by eliminating unsightly projections. This results in a more streamlined housing, a definite sales advantage."

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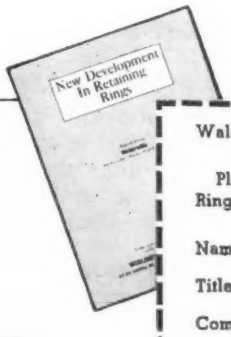

● *Send for new Truarc booklet, "New Development In Retaining Rings"*

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Please send booklet, "New Development In Retaining Rings" to:

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HOUSINGS One a minute!

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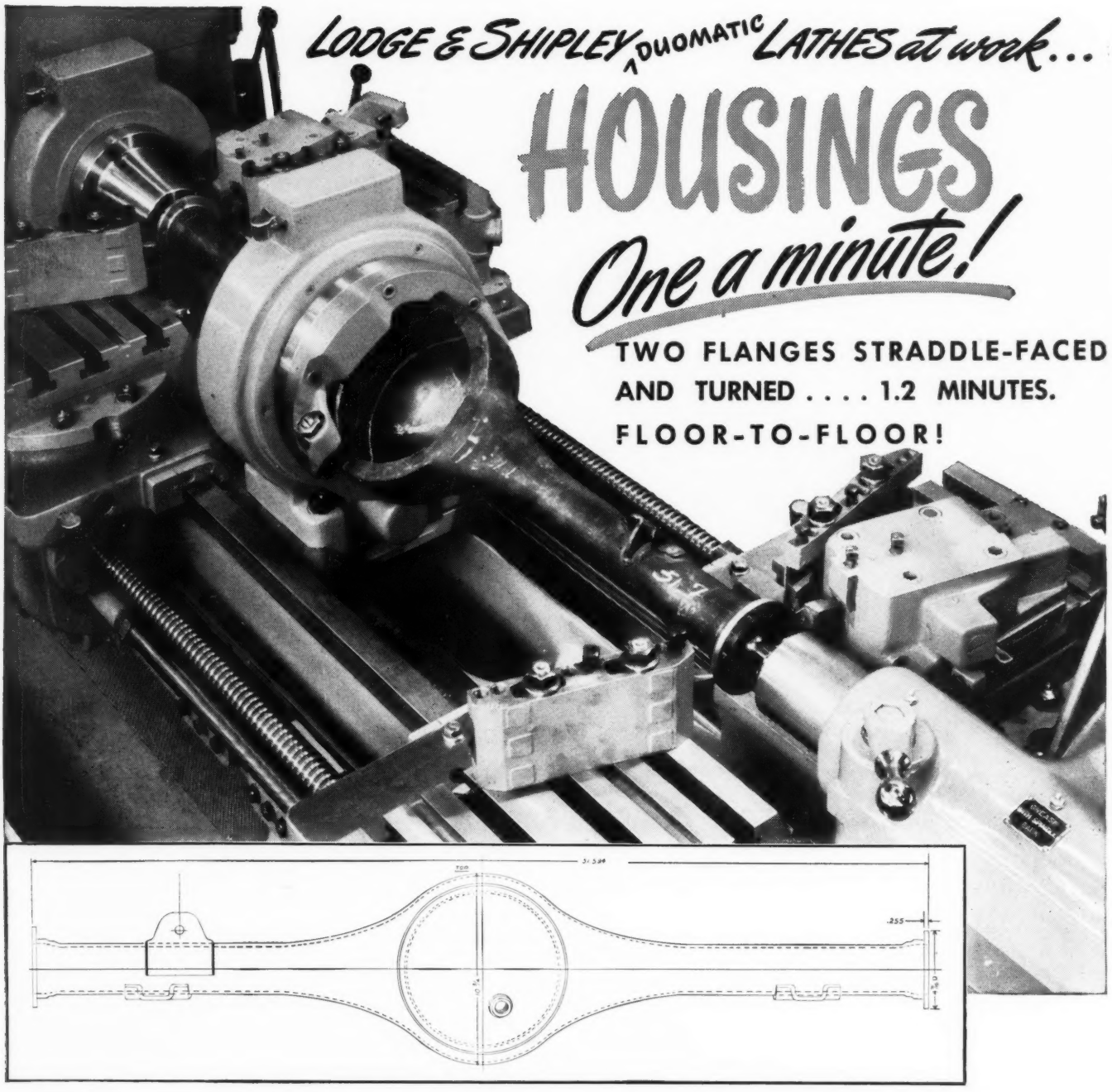

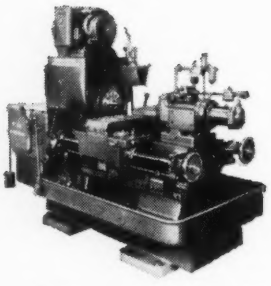

Write for Catalogs No. 634 and 635, illustrating and describing 2-A and 3-A Duomatics for small or large work.

Ordinarily, Lodge & Shipley Duomatic (automatic) Lathes are equipped with dual tool carriages, front and rear, which operate simultaneously. Doubling the Duomatic's already doubled versatility, Lodge & Shipley Engineers added another pair of tool carriages to this lathe . . . obtaining even greater productivity.

At each end of a rough axle housing which is driven from a center fixture, three tools take three cuts at one time, completely turning and facing two flanges. Cycle time, from start to stop, is just 42 seconds; loading and unloading takes 30 seconds more . . . a total of 1.2 minutes.

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To answer these questions you need facts.

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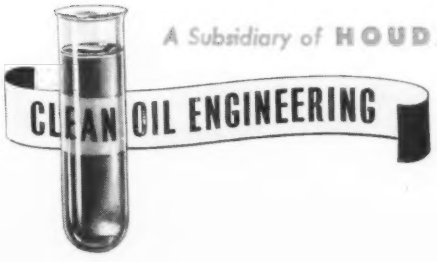

OUTDOOR FURNITURE MAKERS *Can Relax and Rest Easy*

...when their costs are fastened down ... and sales speeded up ... by AMERICAN PHILLIPS SCREWS

VACATION FROM COST-WORRY: Assembly costs are controlled ... *fixed and held as much as 50% lower than you ever saw them before* ... when old-fashioned slotted screws are replaced by modern, power-driven American Phillips Screws, the *only* screws with the crossed, *cornerless* recess. Production and product-quality go up as worker-fatigue goes down. And profits flourish as rejects and spoilage all but vanish.

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4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

AMERICAN PHILLIPS *Screws*

ALL TYPES

ALL METALS: Steel, Brass, Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

BAUSH Cam-Hydraulic-Electric...

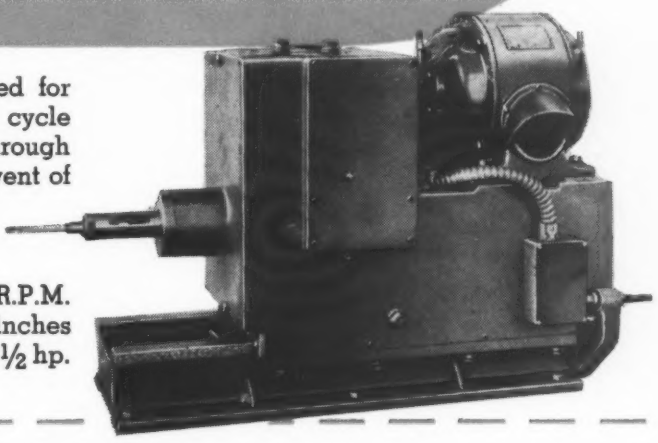
POWER UNITS!

Self-Contained—Dependable—Efficient

These Baush Power Units are adaptable for drilling, reaming, countersinking, boring or counter boring, and the No. 5 Electric Unit is also adaptable for tapping.

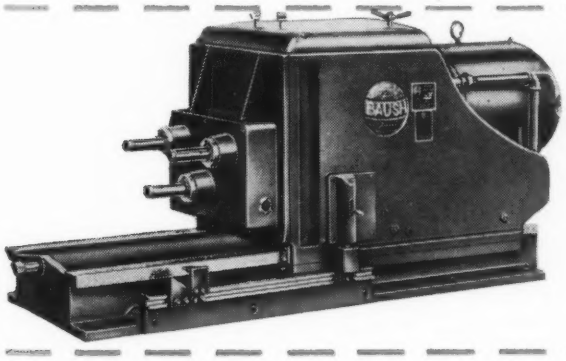
Designed for utility in different constructions, such as Vertical, Horizontal or Angular installations, these Units are built for rugged and continuous production.

A phone call — wire or letter will bring you complete engineering data.



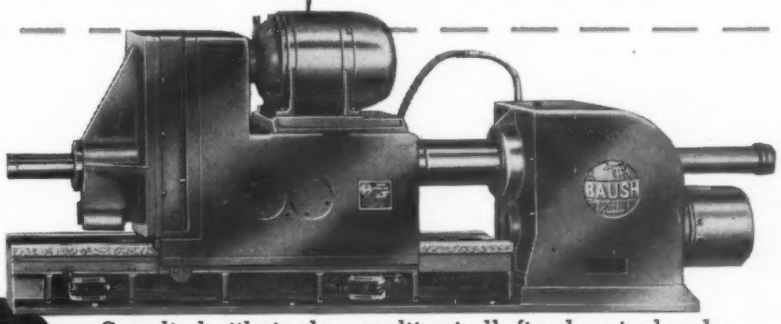
BAUSH CAM FEED POWER UNIT . . . Unexcelled for simplicity on production work. Complete operating cycle controlled by one revolution of cylinder cam through limit switch. Overload clutch prevents damage in event of tool breakage. Fixed center multi-spindle head can be attached to flange mounting. Desired tool speed secured by interchanging pick-off gears.

Spindle Speeds: . . . . . .150 to 1250 R.P.M.
Stroke: . . . . . Model #1—6 inches: Model #2—8 inches
Motor: . . Model #1—Up to 3 hp: Model #2—up to 7½ hp.



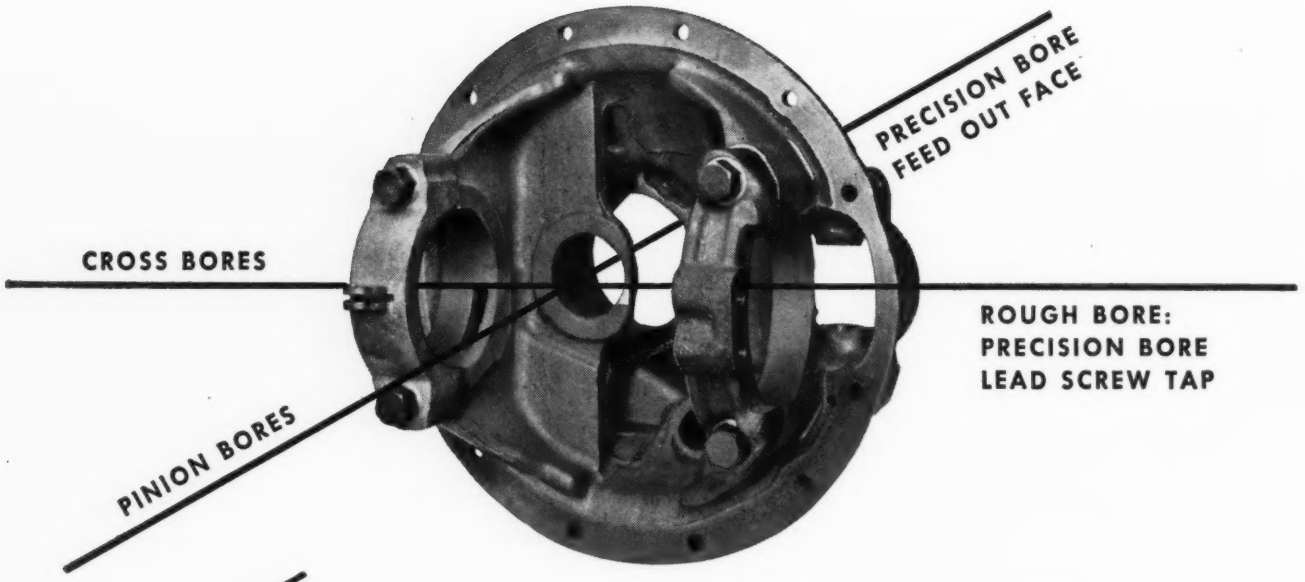
BAUSH HYDRAULIC FEED POWER UNIT . . .
Has self-contained hydraulic system — hardened and ground steel ways — large flange for mounting drill heads.
Spindle speeds easily changed by pick-off gears.
Rapid traverse — dwell or jump feed obtainable if desired.
Spindle Speeds: . . . . . 170 to 930 R.P.M.
Variable Feed Rates From ½" to 20" /min.
Stroke: . . . . . 12" Standard, 18" or 24"
Motor: . Model #20—up to 7½ hp: Model #30—up to 15 hp.

BAUSH #5 ELECTRIC LEAD SCREW POWER UNIT . . .
This Unit is of center feed construction insuring more accurate drilled holes and is readily adapted for boring and facing as well as tapping.

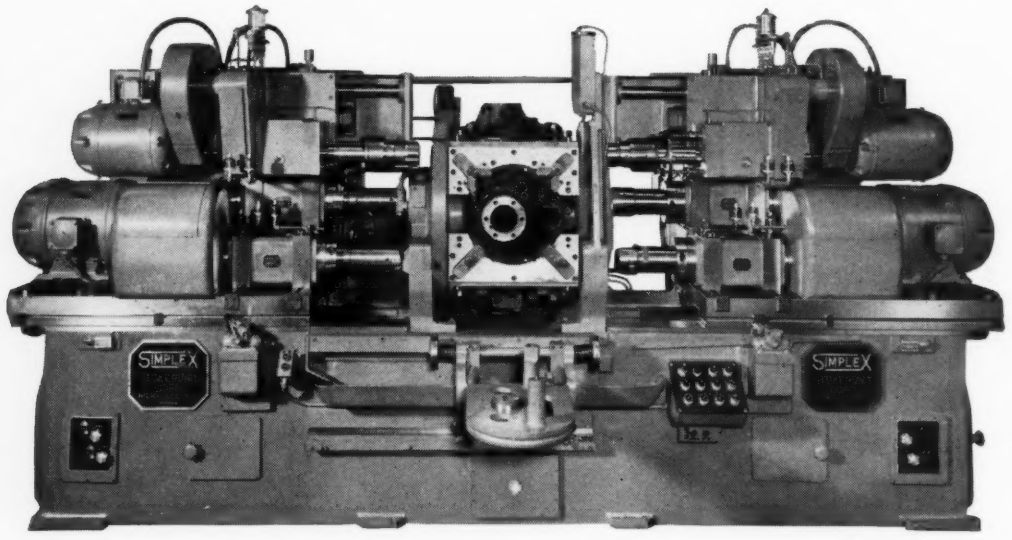


BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

Supplied with single or multi-spindle fixed center heads, these units incorporate many outstanding features:
Traverse speeds of 120" — 150" per min. through 2 hp disc brake rapid traverse motor.
Spindle Speeds of 145 — 1650 R.P.M.
Feed Rates easily controlled through pick-off gears.
Spindle drive motors can be furnished in either 3, 5 or 7½ hp. Stroke: From 12" up to 30" as required.



MARKS THE SPOT WHERE *Precision Pays Off*



A Prominent Manufacturer of Axles greatly increased production, practically eliminated Axle tear down after assembly and lowered costs with these SIMPLEX 3-way Precision Boring Machines. A four-position indexing fixture permits loading on Station No. 1; Rough Boring Cross Bores on Station No. 2; Precision Boring Cross Bores, Pinion Bore and Feed Out Facing Pinion Bore on Station No. 3; Lead Screw Taping of Cross Bores on Station No. 4. A Production of 40 Carriers per Hour has been achieved on this large Truck type differential Carrier. Smaller Car Carriers would permit considerably higher production rates.

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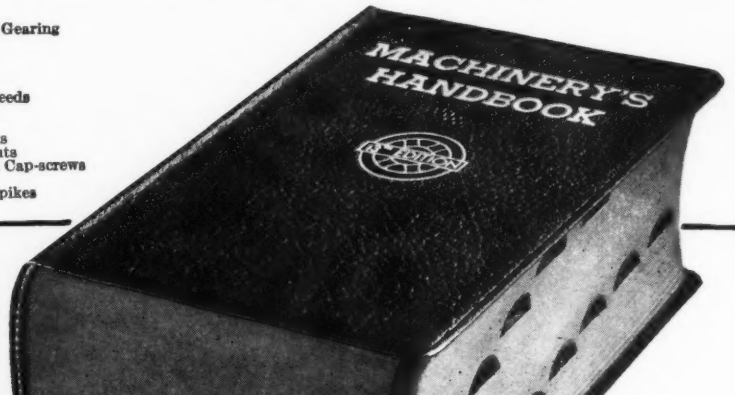

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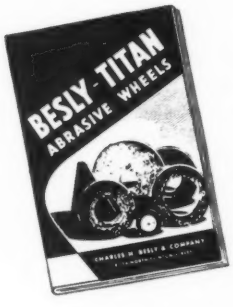

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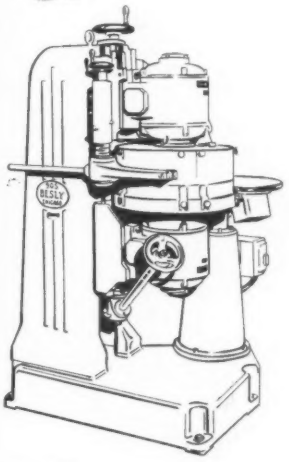

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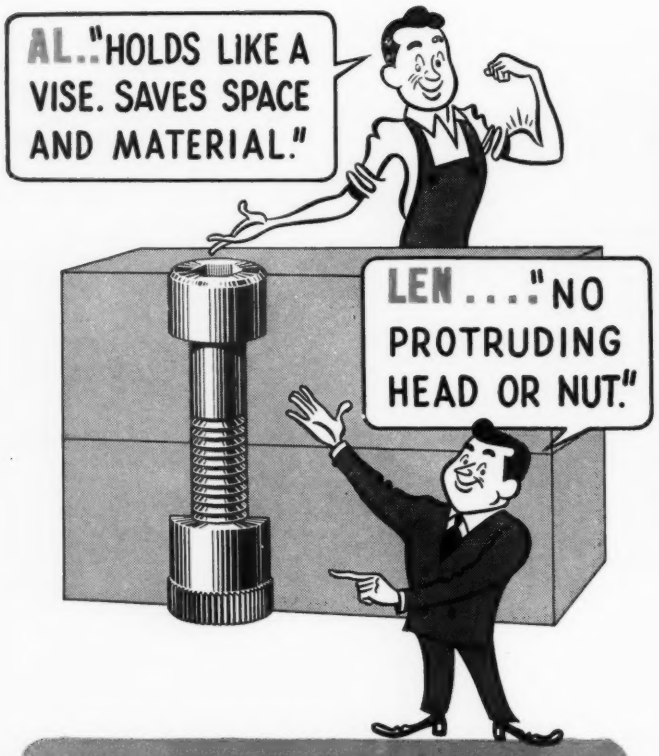

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The Allenut* is the precision counterpart of Allen Hex-Socket Cap Screws. A "ready-made" threaded hole, one end tapped to a Class 3 fit, the opposite end with a double hex socket for wrenching. Greater holding power, easier assembly, more compact design, all are made possible by the new Allenut*, now available from No. 4 to 1", NC or NF threads. Here's another instance to prove that the Allen distributor is the man to see first for the answer to a precision fastening problem. For technical information, write the factory direct.

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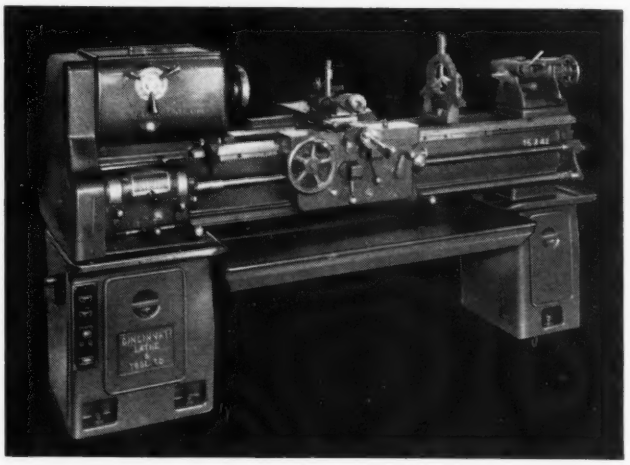

Lightweight Champ: The new Tray-Top line of light duty geared head engine lathes (10", 12½", 15", and 18" swing sizes) offers many "high price" lathe features at truly low cost: 12 spindle speeds, selected by color-coded dial, 48 thread and feed changes, exceptionally large spindles, anti-friction bearings, double-walled apron, totally enclosed quick change gear box, many others. Distance between centers from 18" to 60".

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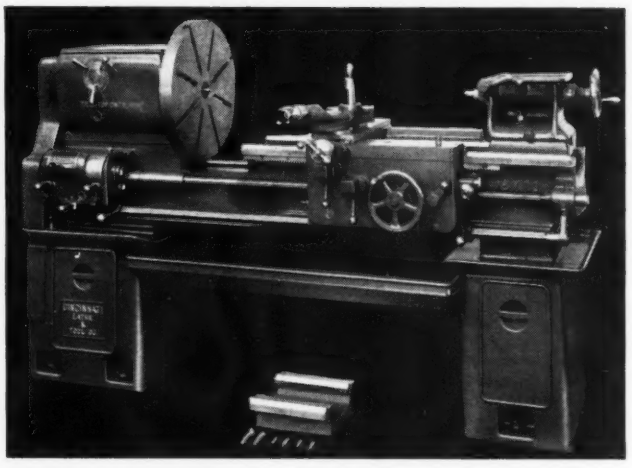

All This – And Gap, Too: 15" and 18" Tray-Tops furnished with gap, give you 22" and 25" swings over gap. Carriage has short wings on headstock end for maximum approach of tool, wings on tailstock are extended for maximum rigidity and adequate bearing surface on bed. Like regular Tray-Top, distance between centers from 18" to 60", in increments of 6". All furnished with regular lathe attachments and accessories.

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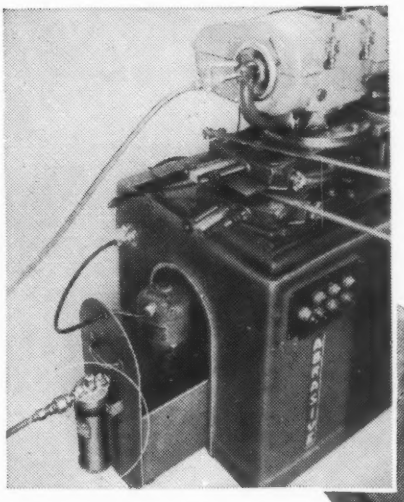
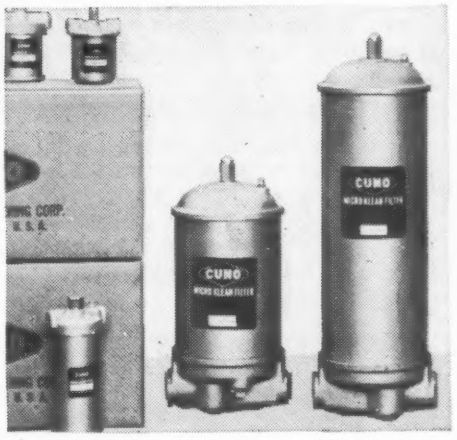
Making a Couple of Cool Millionths

Abrasive Carbide Finisher grinds tungsten carbide to less than 2 millionths of an inch root-mean-square roughness. Metal and abrasive particles which would damage work surface are removed from recirculating coolant by Cuno MICRO-KLEAN Filter.



Handles wide range of fluids

In another application at Teaneck Chemical Co., Cuno MICRO-KLEAN with 25-micron cartridge handles 1-2 gpm of very viscous photographic chemical solution at 65 psi.



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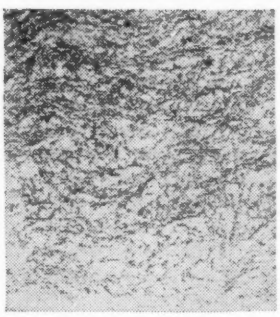
Cuno MICRO-KLEAN filters come in densities of 25 and 10 microns . . . capacities from a few to 850 gpm . . . connections from $\frac{3}{8}$ in. IPS to 6 in. flanged . . . single or multiple cartridges to handle full flow. MICRO-KLEAN cartridges fit other makes; special lengths available for built-in installations.

● Making the broadest line of fluid filters, Cuno is *your* best source for unbiased recommendations on any fluid filtration problem.

Cuts cartridge replacement in half

Exclusive fibre construction of Cuno MICRO-KLEAN permits smaller particles to penetrate to varying depths. No surface-loading—graded-density-in-depth increases dirt capacity—doubles cartridge life. Resinous impregnation and polymerization bonds each fibre in position to prevent channeling, rupturing, shrinking and distortion.



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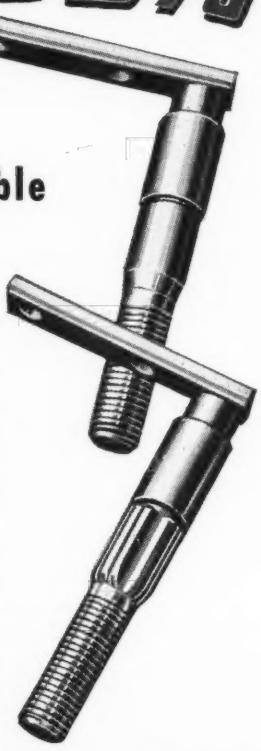
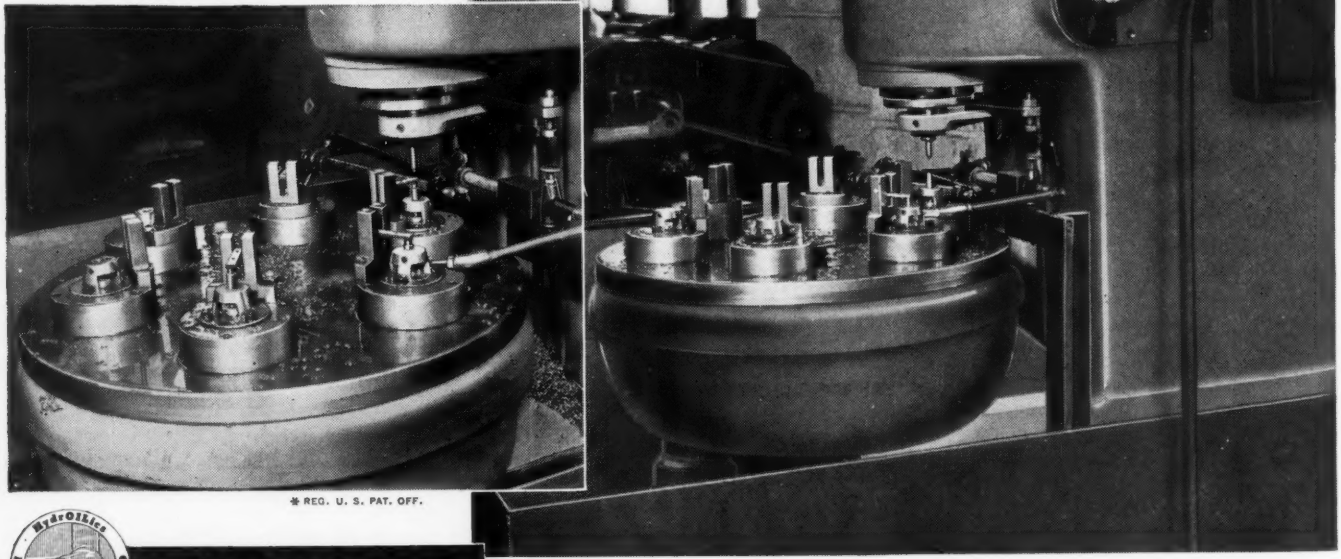


● Production jumped from 500 to 1500 parts per hour when a 6-ton MULTIPRESS and its Denison HydrOILic Index Table were recently installed at The Pivot Manufacturing Company of Detroit, Michigan. The job consists of broaching ⅝-inch splines on shafts used to regulate quarter windows of automobiles.

The operator simply places the shafts in the fixtures of the six-station MULTIPRESS Index Table as they pass the loading station. The parts are then indexed automatically to the ram station, where the press ram forces the shaft through the broaching tool. At the station just beyond the ram, the finished parts are pushed up from the broaching die by a cam within the index table housing, while an air-blast cleans the broaching die and the part.

This MULTIPRESS equipment reduced the operator's work to an easy loading-and-unloading operation. Its uniform oil-hydraulic pressure greatly reduced reject losses, which had been excessive. Also, by ejecting the broached shafts back out of the die, instead of pushing them on through as before, MULTIPRESS makes it possible to weld the cross members to the shafts before broaching. This ended the previous distortion of finished shafts during welding of cross members.

MULTIPRESS *offers quiet, oil-smooth accuracy of power in 1, 4, 6, 8, and 25-ton capacities, with manual and automatic controls for almost any type of ram action. The HydrOILic Index Table is only one of many standard* MULTIPRESS *attachments, tooling accessories and automatic feed devices that adapt the basic* MULTIPRESS *to hundreds of needs. Scores of case-history reports on various applications similar to this one are on file—your production may be improved the* MULTIPRESS *way, too. Write for details.*



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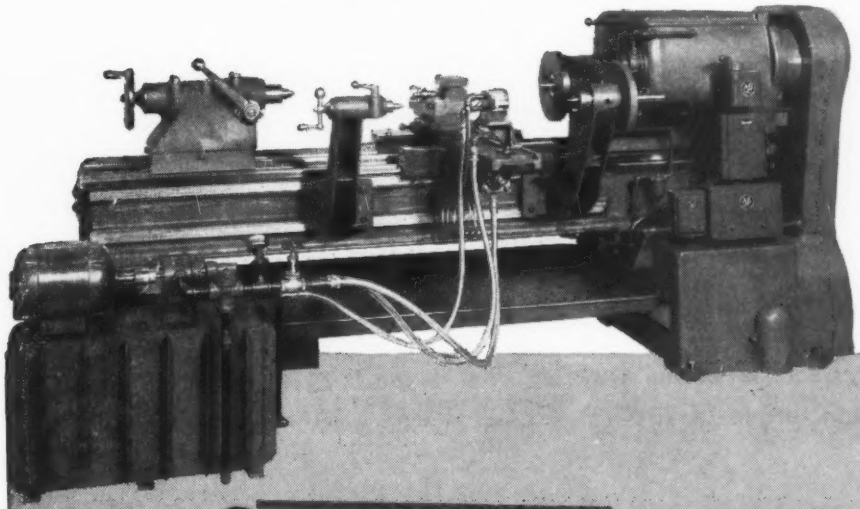

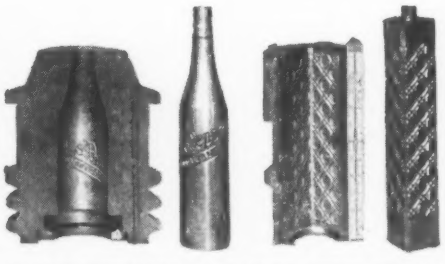

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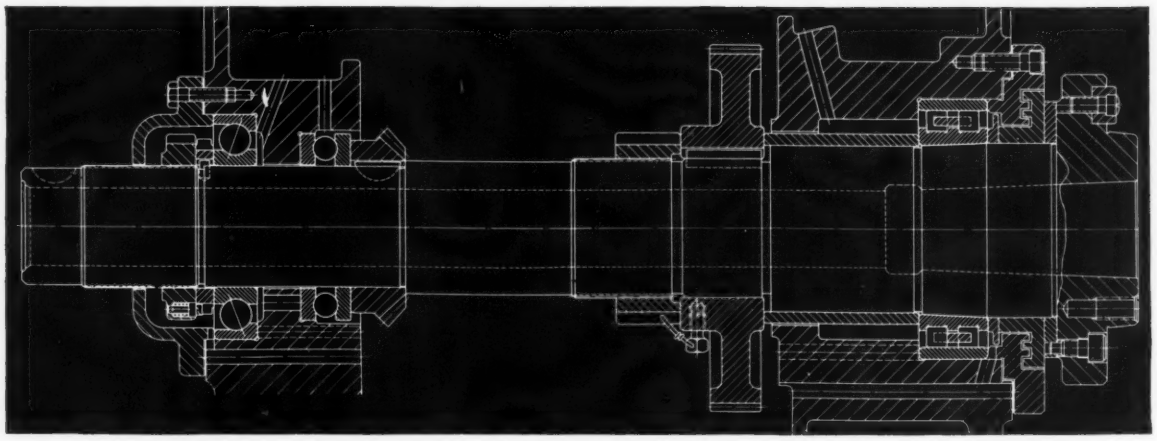

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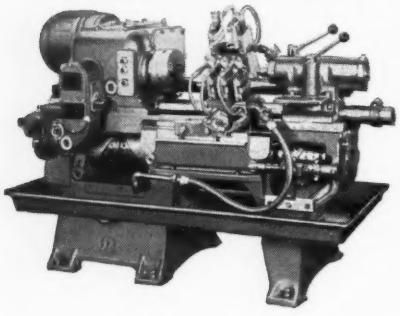

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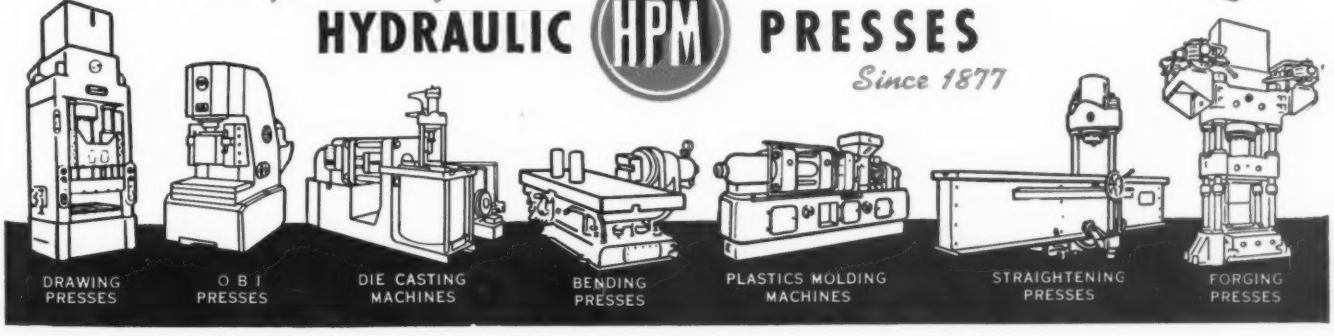

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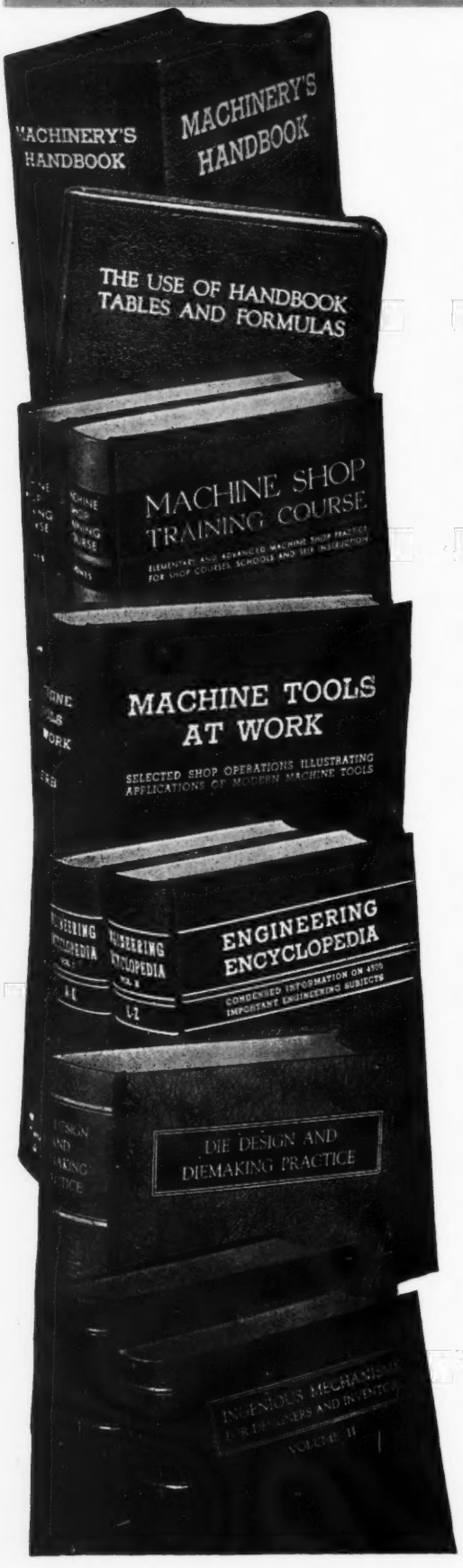
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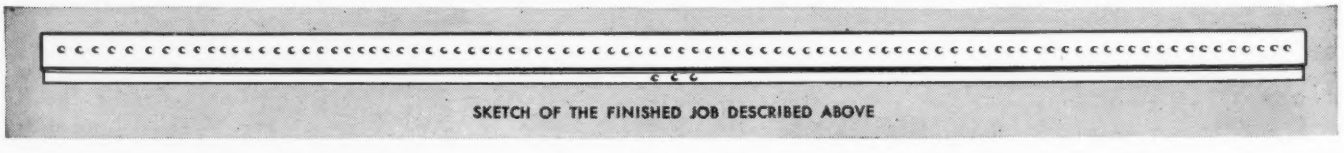

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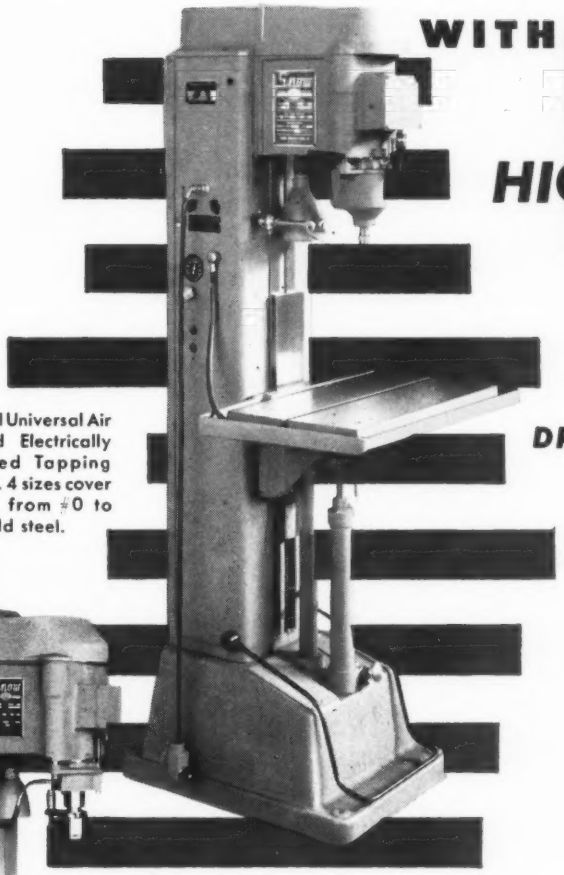

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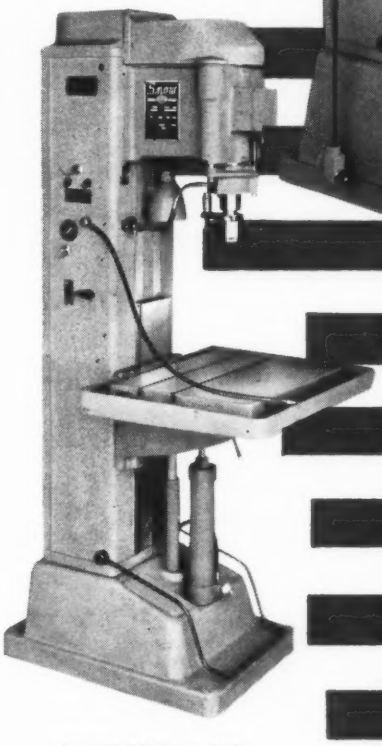

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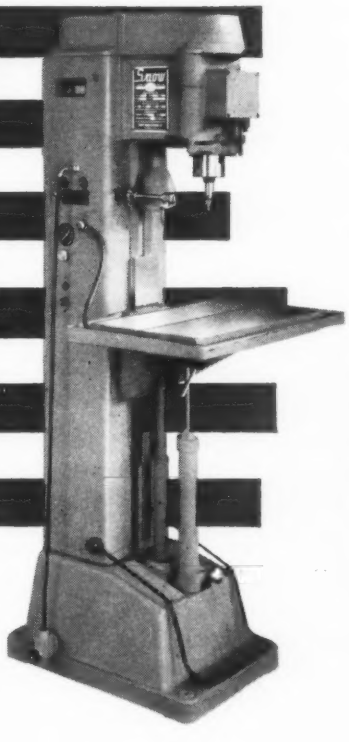

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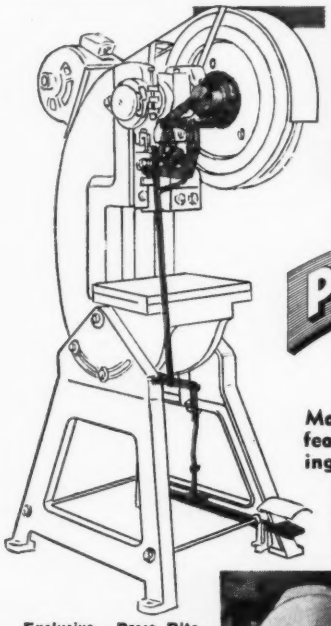

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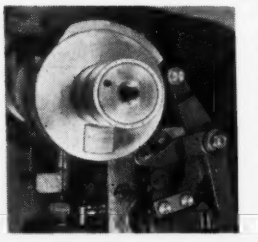

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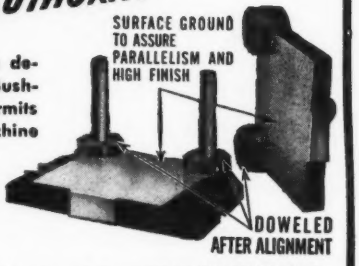

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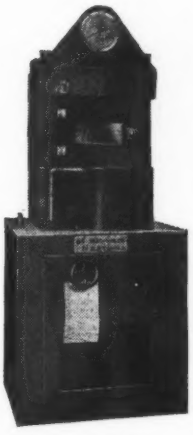

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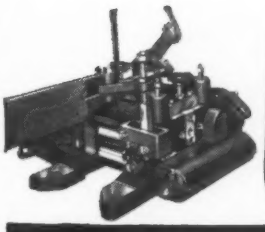

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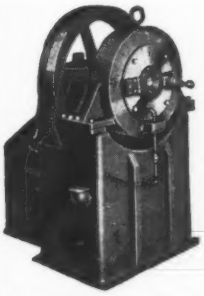

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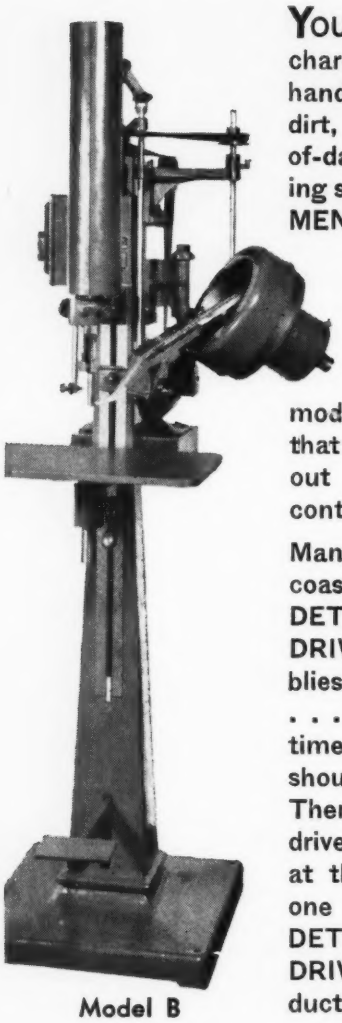

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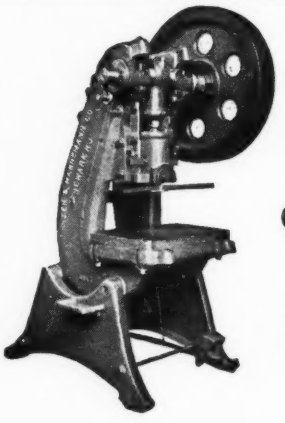

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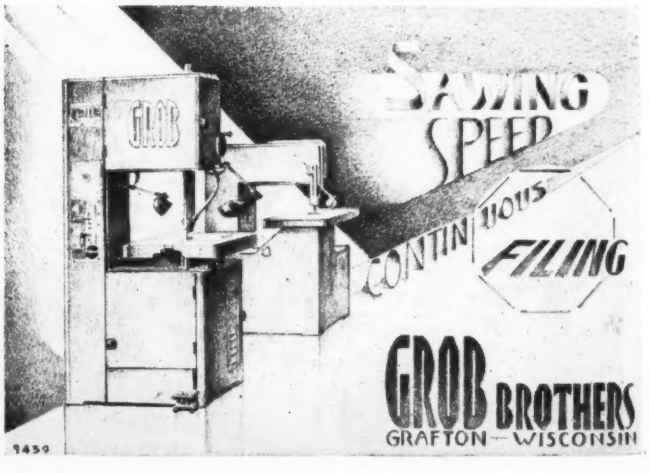

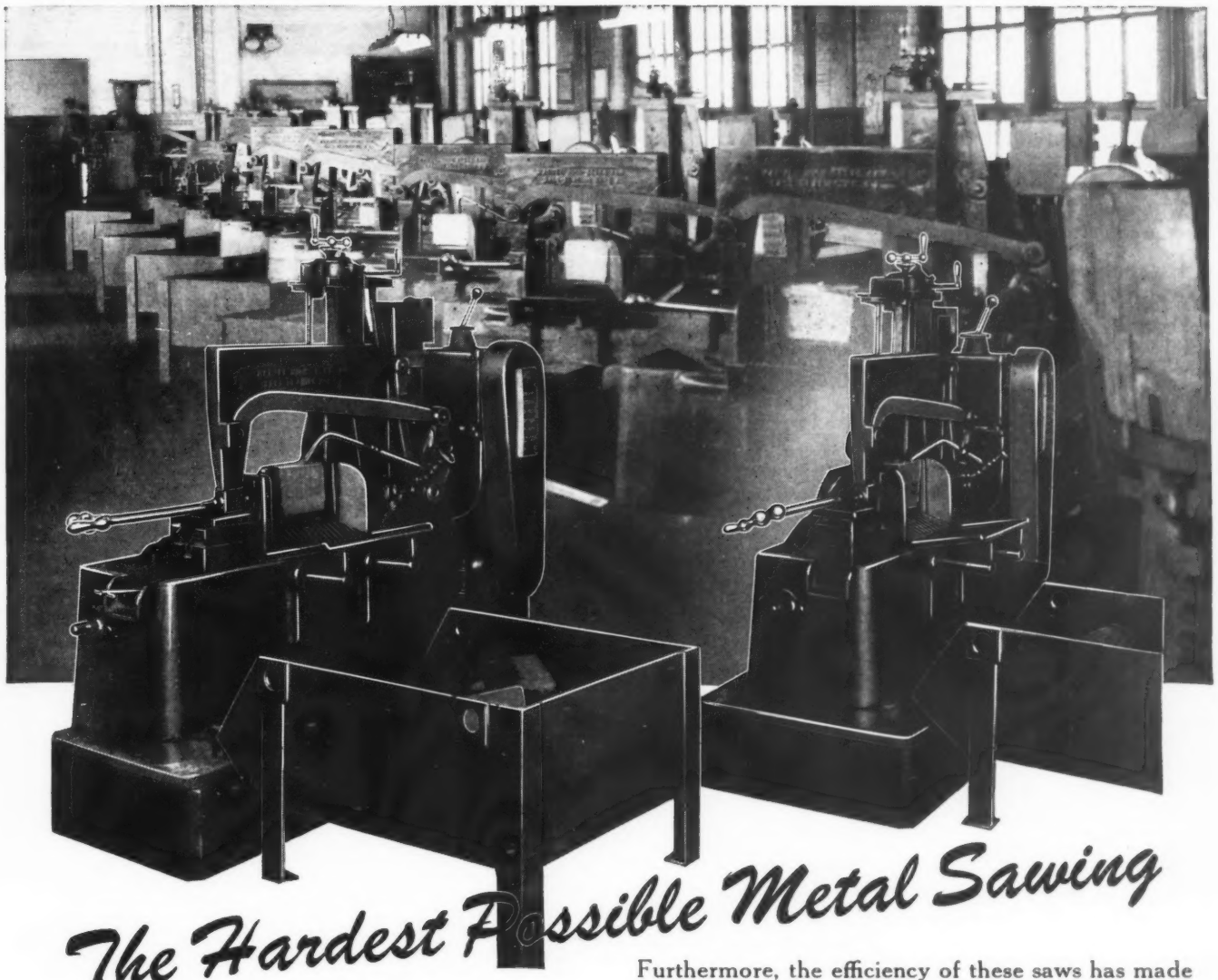

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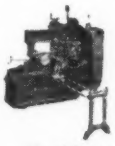

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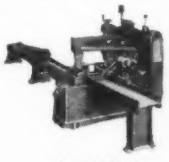

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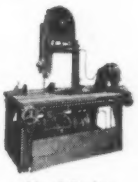

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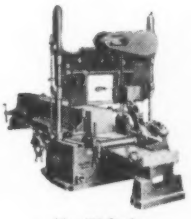

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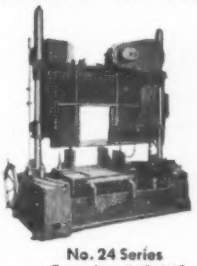

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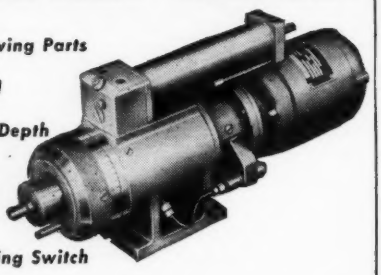
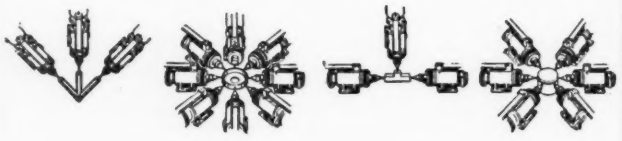


The ingenious simplicity of engineering design in the CRT Power Unit brings a lifetime of performance in many production operations. Use its' controlled power for drilling, chamfering, spin-riveting, spot facing, sawing and end milling.



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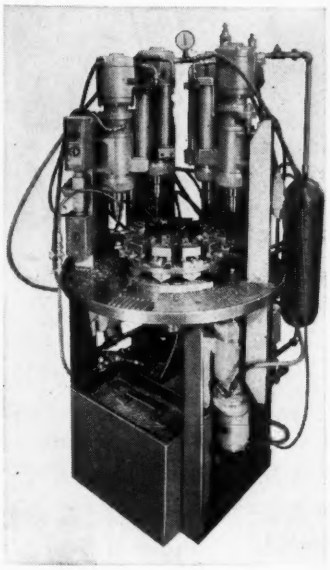

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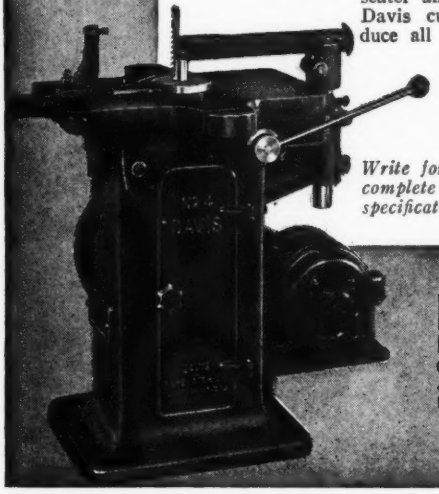

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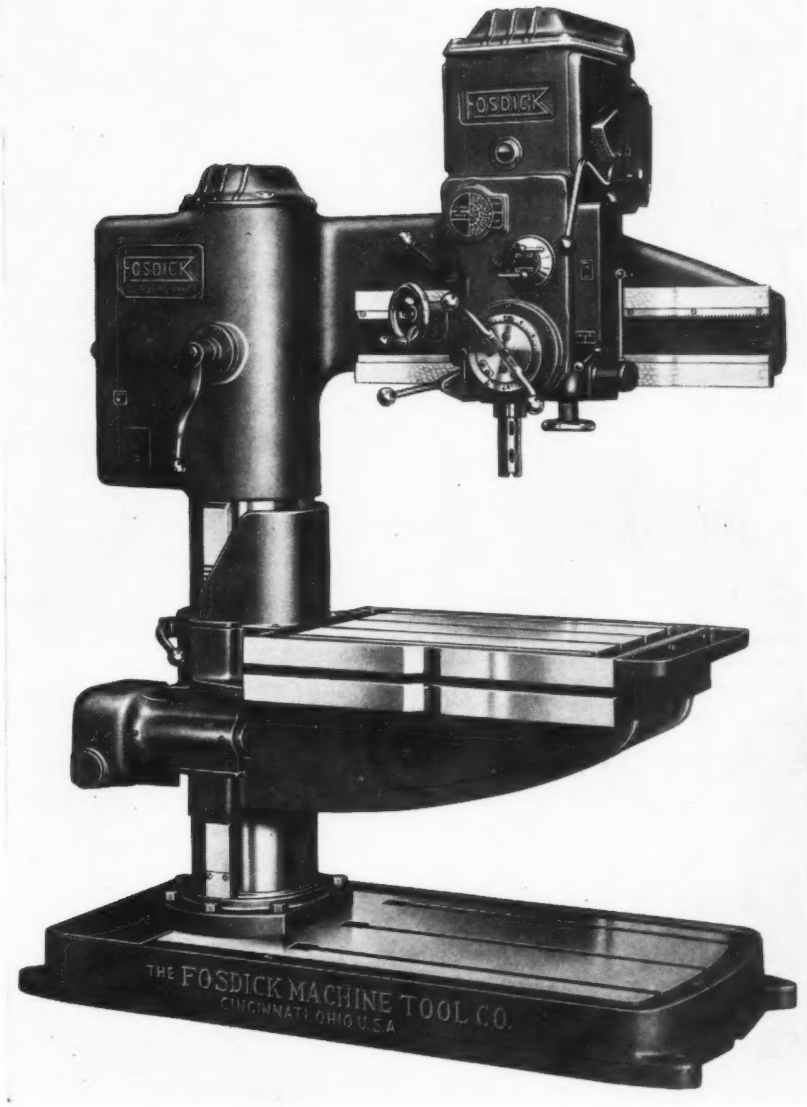

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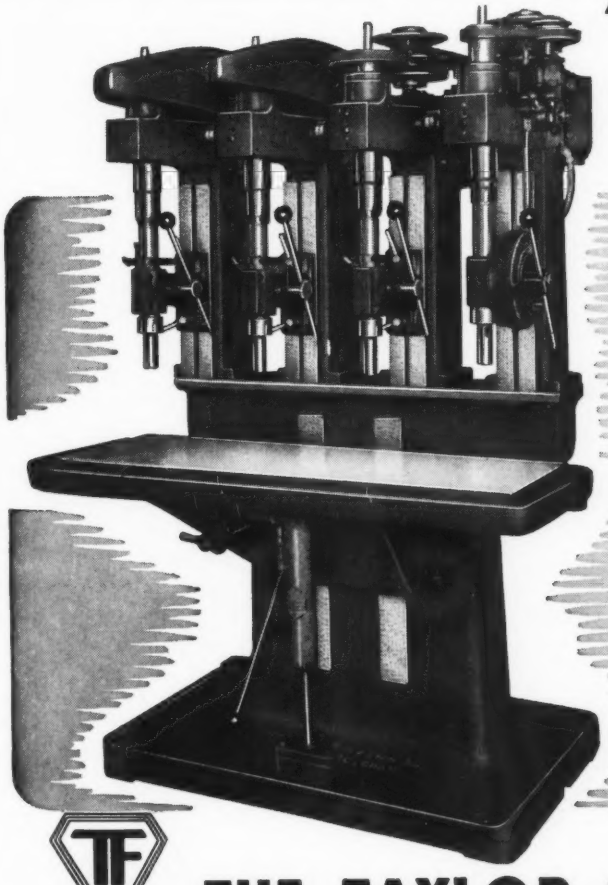

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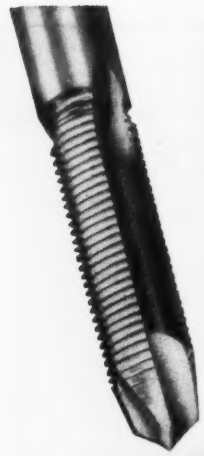

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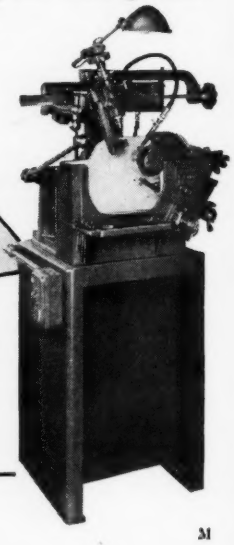

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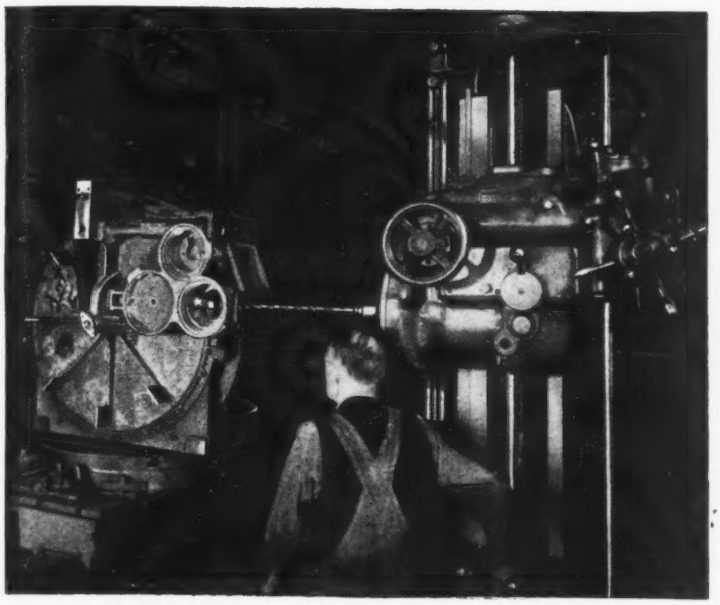

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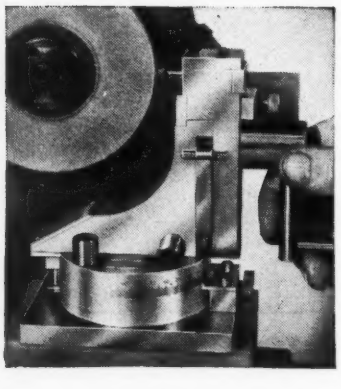

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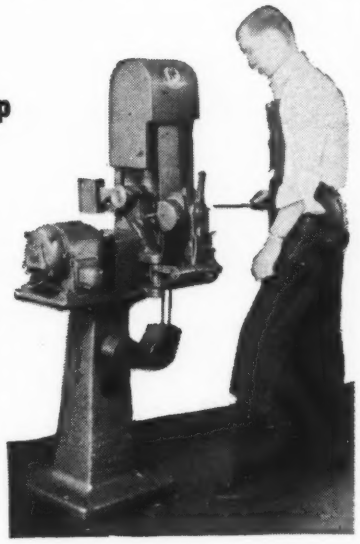

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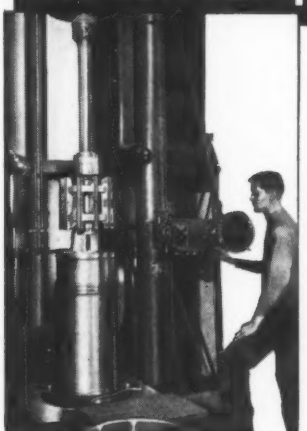

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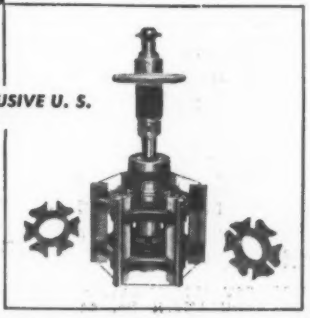

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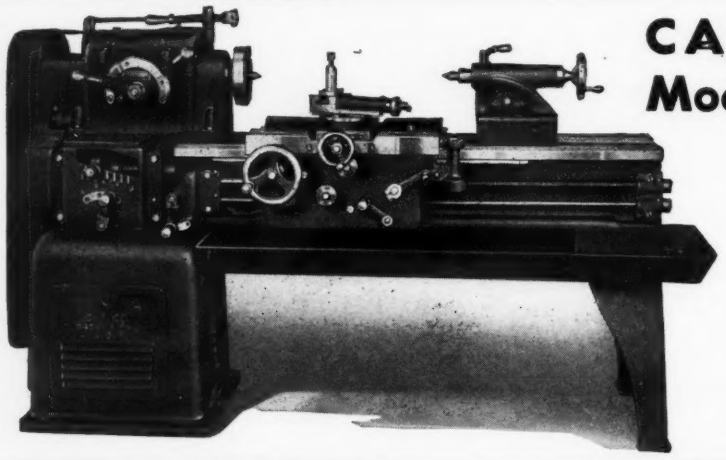

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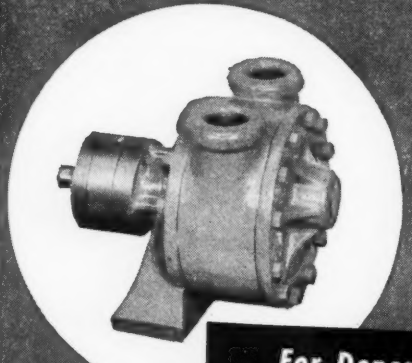

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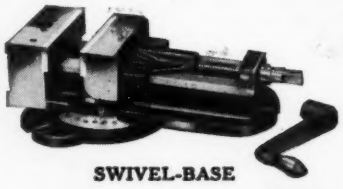

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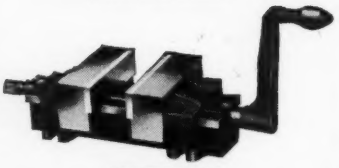

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Milling Machines

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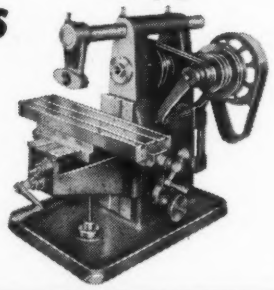

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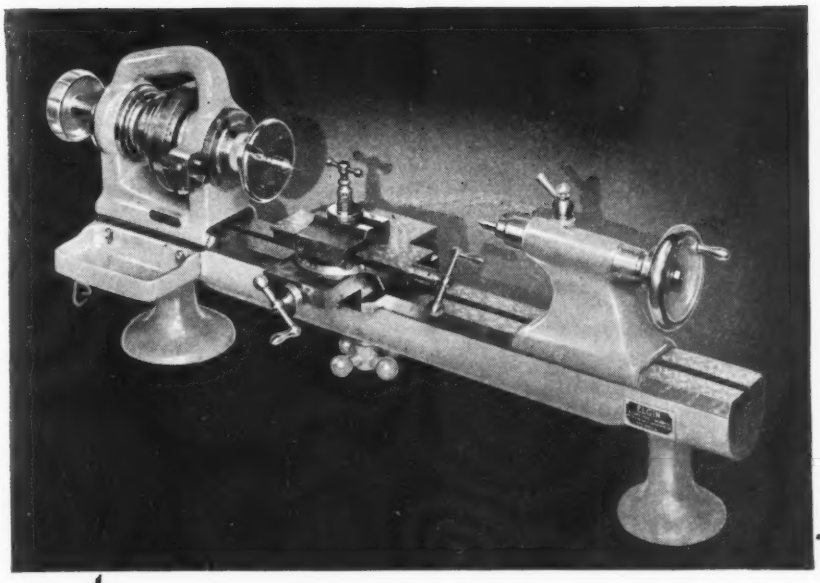

ELGIN Precision Bench Lathe
Model 4EV

Same heavy-duty construction as Model CB-5C, and same high precision and sensitivity. Precision preloaded ball bearings. 7" swing, 17" between centers, 32" bed, 7/16" collet capacity (No. 4E collet). Spindle nose ground thread, speeds up to 10,000 RPM. Open cone V belt headstock. For either V or flat belt operation. Tailstock, 2¾" spindle travel. Compound slide rest (extra), 4½" parallel travel, 4¼" cross travel, swivels 360°. Hardened tool post takes 5/16" x ¾" tool holder. Shipping weight, approx. 175 lbs.

CLOSEST ACCURACY on small-parts machining is assured with ELGIN Precision Bench Lathes. They're designed for fast, economical operation, too. Both the Elgin Lathes shown here feature extra-heavy spindle and base construction for positive rigidity . . . precision preloaded ball bearings that insure true running at all speeds and under all conditions . . . greater sensitivity and higher precision than ever before. Write for details about these and other Elgin Precision Bench Tools (Lathes, Screw Machines, Millers).

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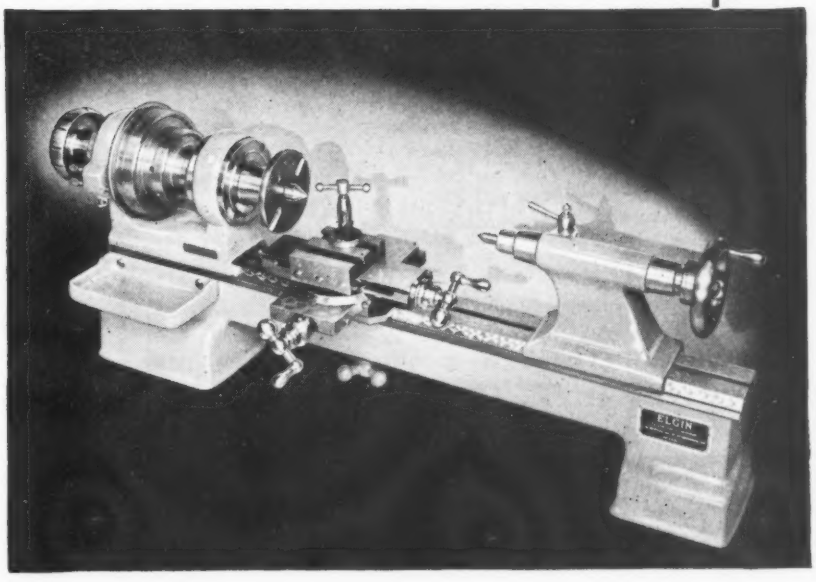


ELGIN Precision Bench Lathe
Model CB-5C

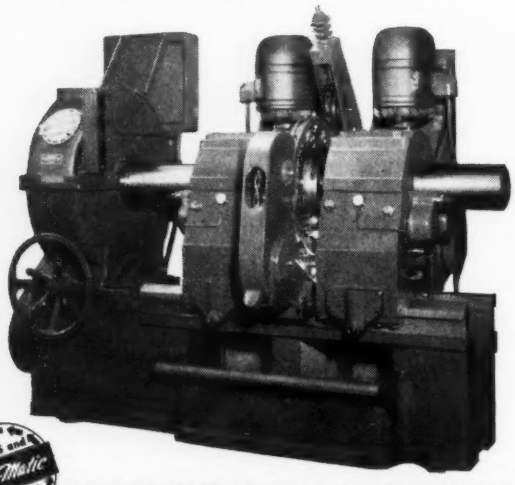
Extra-heavy spindle and base construction for positive rigidity, precision preloaded ball bearings that assure true running at all speeds, under all conditions. 9" swing, 17" between centers, 36" bed, 1" collet capacity (No. 5C collet). Spindle hardened and ground—spindle nose, taper or ground thread. Speeds up to 4,000 RPM. Open cone headstock. Flat belt only. Tailstock, 3½" spindle travel. Compound slide rest (extra), heavy-duty, 5¼" parallel travel, 5¼" cross travel, swivels 360°. Double tool post slots. Hardened tool post takes ⅜" x 1" tool holders. Shipping weight, approx. 225 lbs.

Roto 1-A Matic

HORIZONTAL PRODUCTION MILLERS

FEATURING

1 CONTINUOUS OPERATION
2 AUTOMATIC CHAIN CLAMPING
3 ROUGH & FINISH CUTTERS — EACH HEAD
4 3 TYPES — VARYING BED LENGTHS
5 LOW MAINTENANCE COST
6 INTERCHANGEABLE FIXTURES



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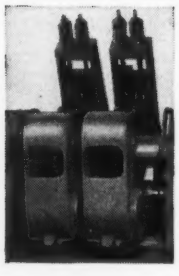
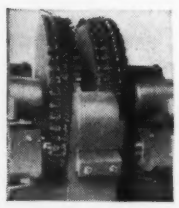


Chain Clamping Fixture for rough and finish milling both ends of Control Arm Trunions to length. Interchangeable buttons make possible the milling of several sizes — Production 296 gross per hour.



Double Chain Clamping Fixture with a total of 28 stations for milling ends of Clutch Gears — Production 200 gross per hour — With this arrangement two different parts can be milled simultaneously.

Double Drum—50 automatic holding fixtures on each drum for rough and finish milling radius on Rocker Arms — Production 1400 gross per hour.

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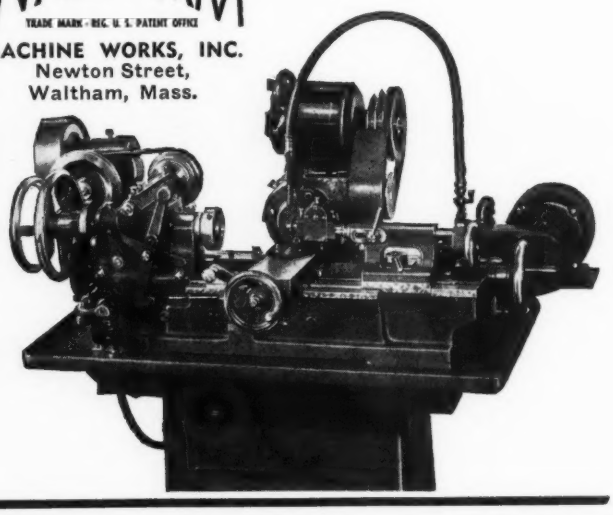

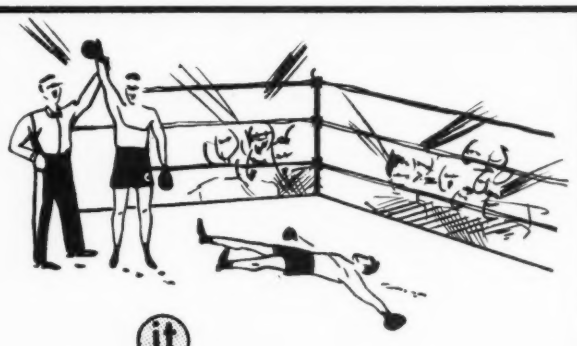

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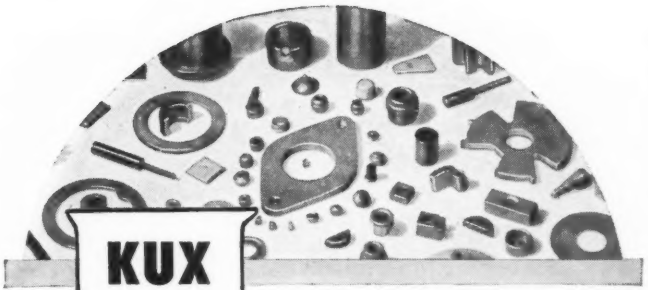

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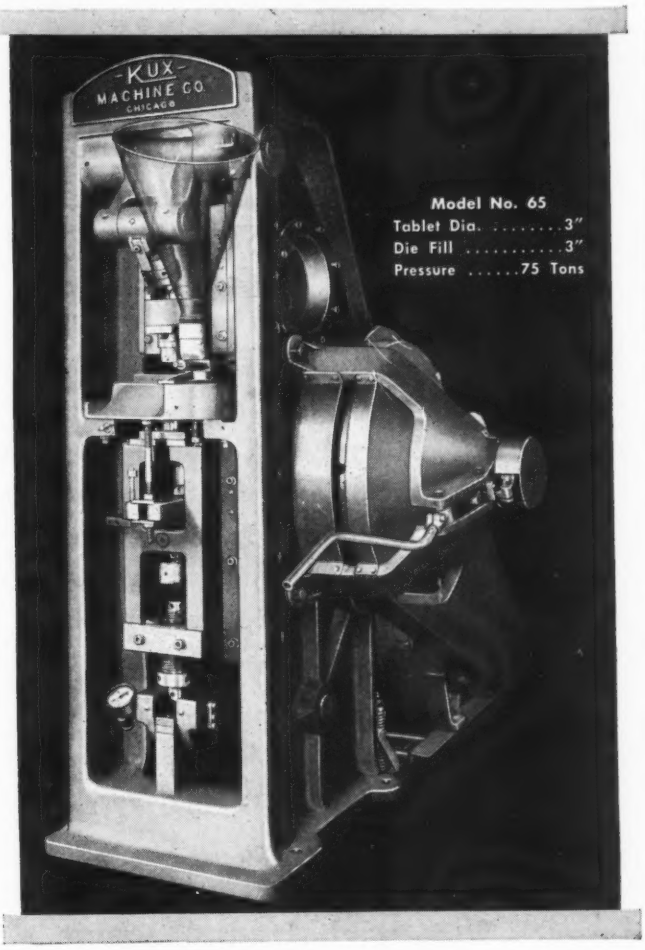

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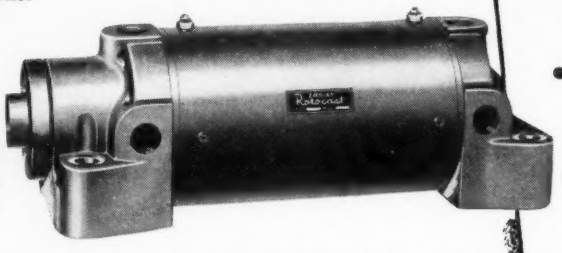

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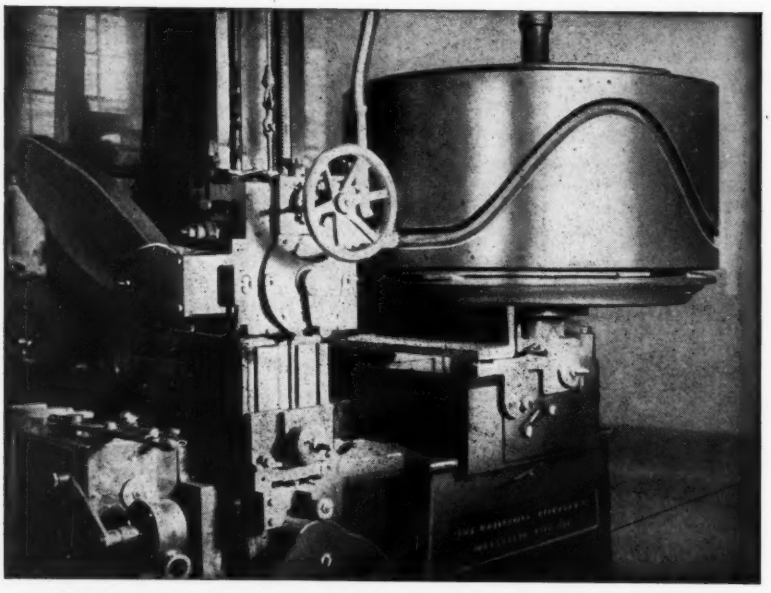

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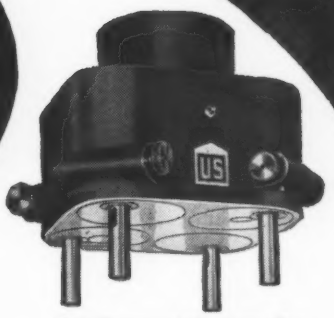
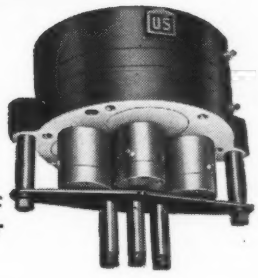


Single eccentric type for equally spaced holes on bolt circles.



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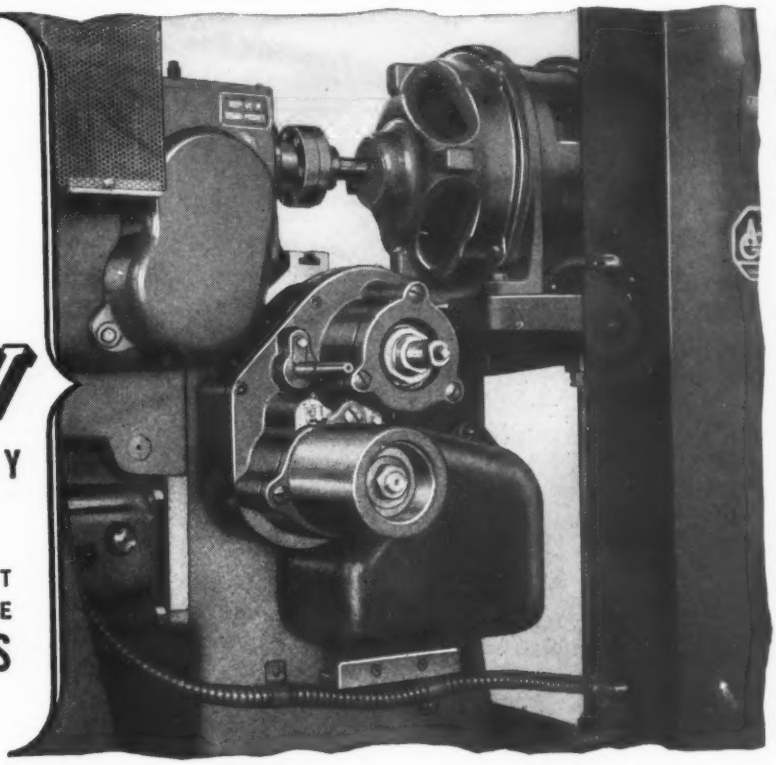

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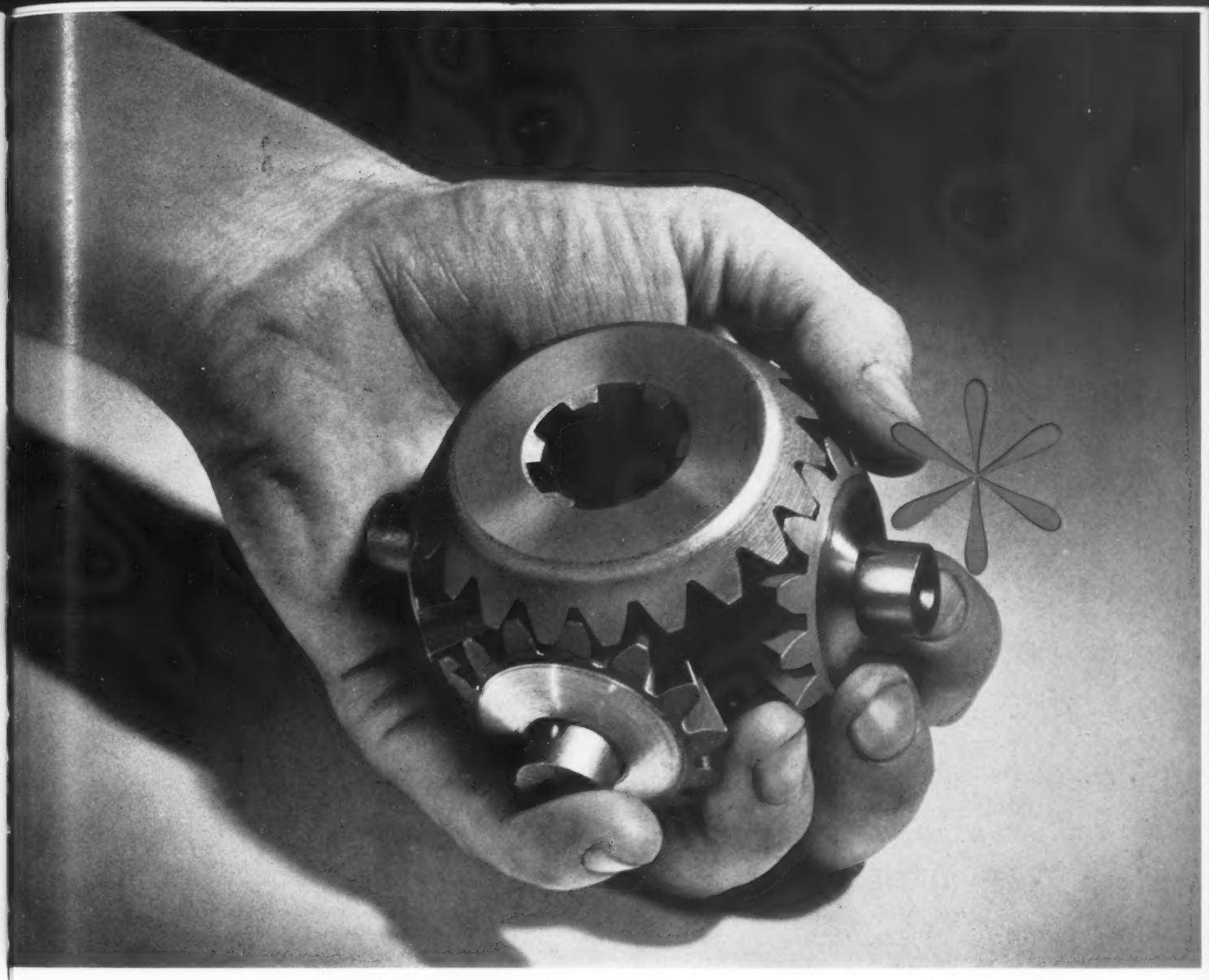

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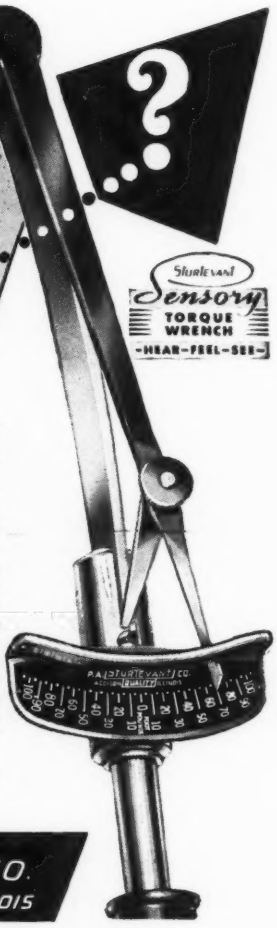

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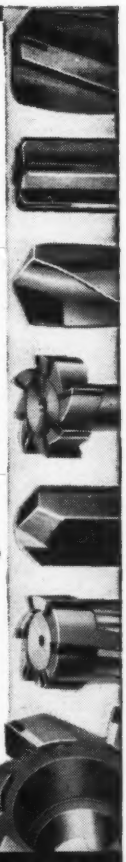

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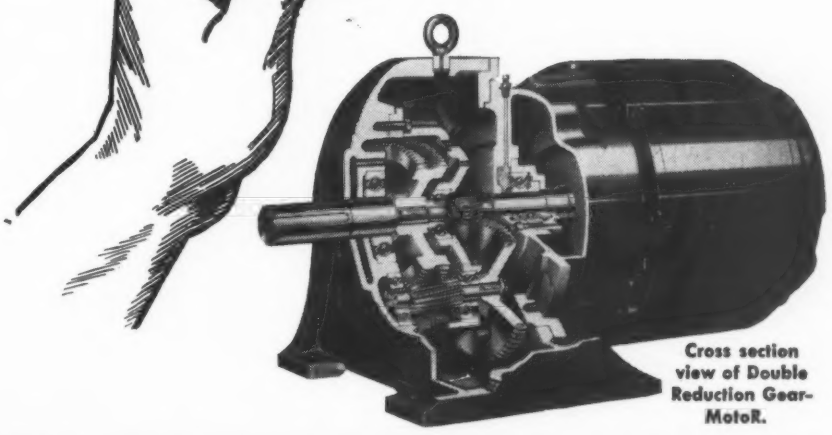

Cross section view of Double Reduction GearMotoR.

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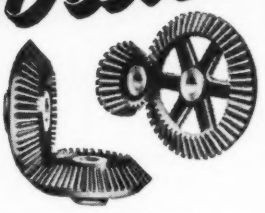

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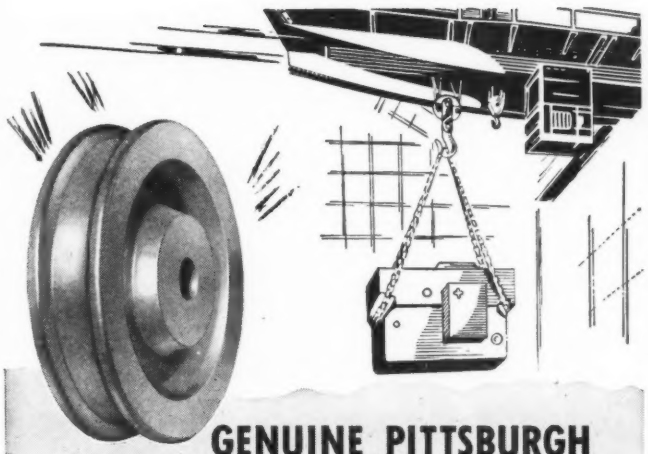

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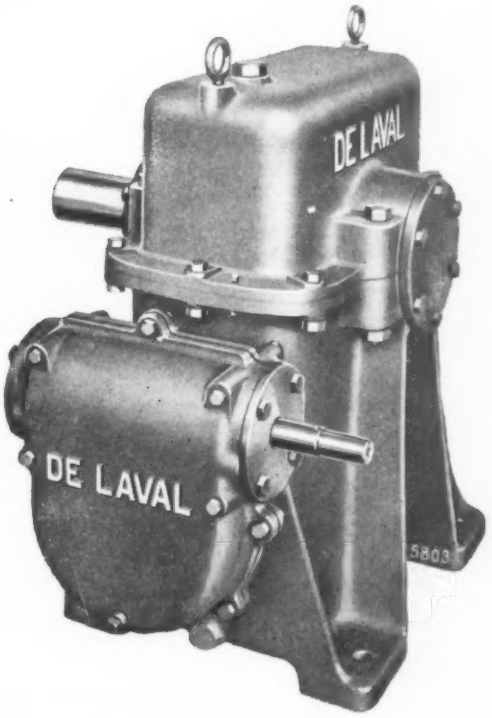
HIGH TORQUES?

DE LAVAL SPEED REDUCERS

For low final speeds Worm Gear Speed Reducers should be selected on the basis of output torque ratings.

If your problem is to select a gear reducer capable of carrying high torques, consult De Laval, either directly or through a sales representative.

ONE OF 93



This double reduction De Laval Worm Gear Speed Reducer is available with many standard gear ratios and is but one of 93 sizes and types of standard De Laval Worm Gear Speed Reducers.

Worm Gear Division

DE LAVAL WG-11

De Laval Steam Turbine Co., Trenton 2, N. J.

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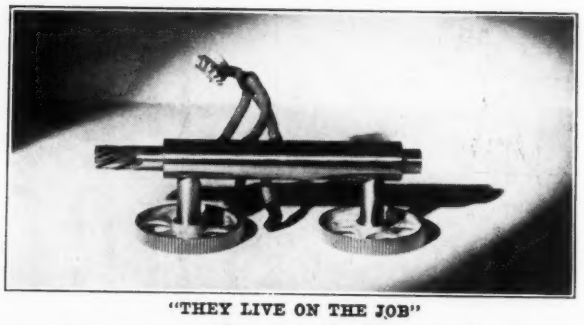

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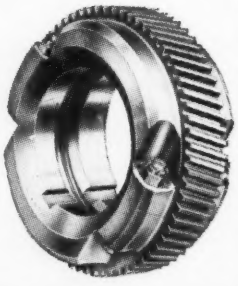

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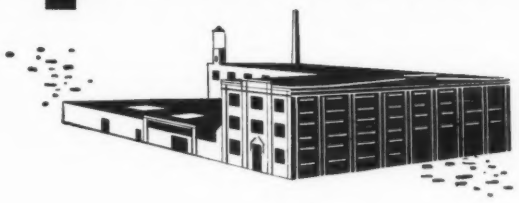

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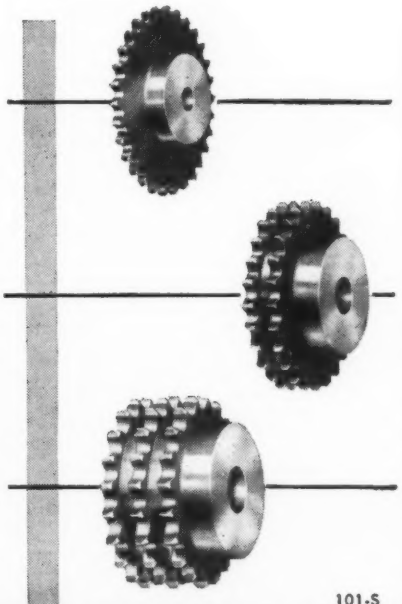

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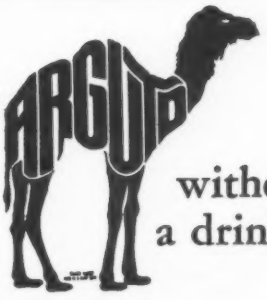

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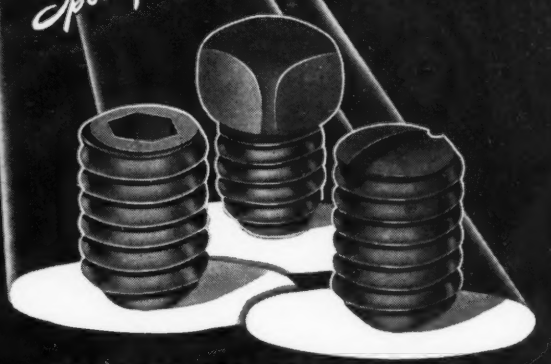

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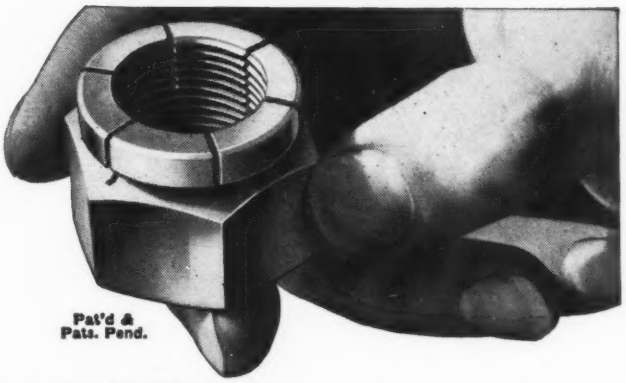

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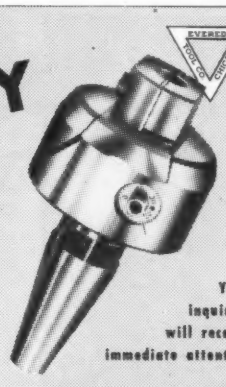

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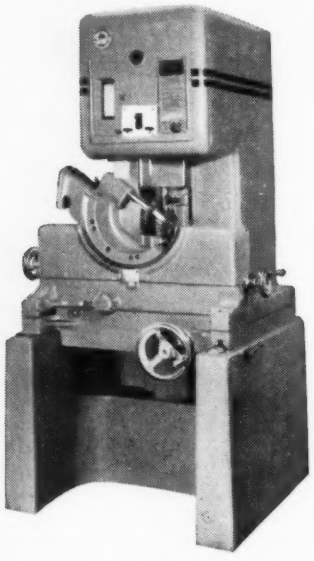
Kodak Conju-Gage, Model 8U, tests gears up to 8¼ inches in diameter. Smaller models check gears up to 1¼ inches and 4⅛ inches, respectively, in pitch diameter.



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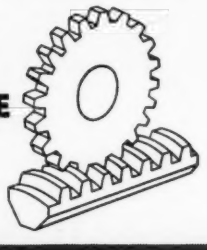

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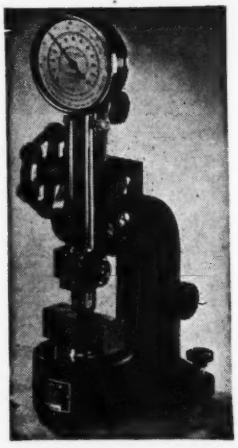

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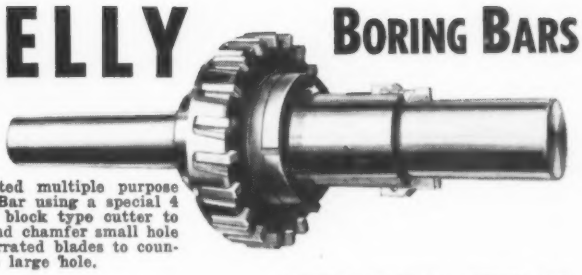

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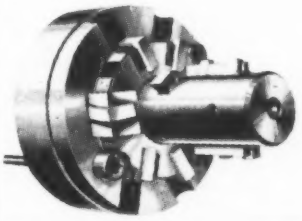

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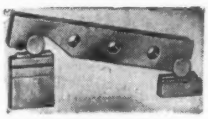

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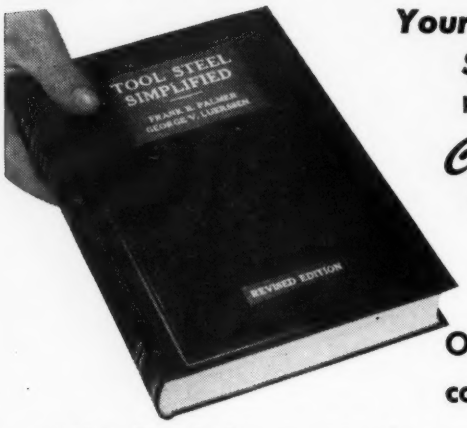

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4. The Character of Tool Steel
5. The Soundness of Tool Steel

Part II—Selecting the Right Tool Steel for Each Kind of Tool

6. The Matched Set Method
7. The Twelve Matched Tool Steels
8. The Matched Set Method in Use
9. The Tool Steel Selector

Part III—Properties, Heat Treatment and Testing of Tool Steel

10. Heat Treating Methods and Equipment
11. Hardness and Toughness Testing
12. Properties and Heat Treatment of Twelve Matched Tool Steels
13. High Speed and Hot Work Steels

Part IV—Things Worth Knowing

14. Relation of Design to Heat Treatment
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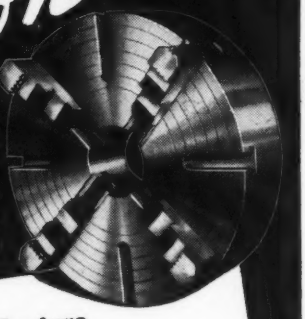

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Univ. No. 44 Tri-way, 4½" Bar.
Univ. 4" bar Tri-way.
Yoder 3A. 3" bar.
Bullard 24", 36", 42" Spiral Drive.

PLANERS

Cin. 78" x 56" x 22', 4-hds.
Cin. 60" x 48" x 25' Hypro, 4-hds.
Liberty 72" x 72" x 20', 4-hds. (1942 machine).
Putnam 84" x 84" x 40', 4-hds., rev. M.D.

NEW RAFTER SHEARS
2 Sizes

¼" x 10'— mild steel.	3/16" x 12'— mild steel.
⅛" x 10'— stainless steel.	3/32" x 12'— stainless steel.

Immediate delivery from stock.

COMPLETE YOUR MACHINE TOOL FILES —SEND FOR COMPLETE LISTINGS.

Botwinik Brothers
OF MASS., INC.
14 SHERMAN ST., WORCESTER 1, MASS.

DIRECT FROM STOCK

Power Presses—Turret Lathes
Milling Machines—Lathes
Industrial Equipment of all types

FALK MACHINERY CO.
18 WARD STREET, ROCHESTER, N. Y.

Eastern Rebuilt Machine Tools

THE SIGN OF QUALITY
THE MARK OF DEPENDABILITY

RADIAL DRILLS

2' Fosdick, 9" col., gear box
3' American Sensitive, cone
3'-10" Fosdick, gear box
4' American Sensitive, m.d. on arm
4'-12" Fosdick, gear box
4'-13" American, gear box
4' Niles-Bement-Pond Semi-Universal, m.d.
5' American Triple Geared, 13" col., gear box
5'-13" Cincinnati-Bickford, m.d.
5' Cincinnati-Bickford Full Universal, gear box
5' Cincinnati-Bickford Plate Hole Driller, m.d. on arm
5' Prentice Plain, m.d.
6'-15" Carlton, gear box, inclosed head
6'-15" Cincinnati-Bickford, with 7' arm, m.d.
6' Niles-Bement-Pond Semi-Universal, m.d.
6'-16" Western, m.d.
7'-17" Dreses, gear box, m.d.
8'-16" American Triple Purpose, m.d. on arm
8'-19" American Triple Purpose, m.d. on arm, 1942 machine
10'-22" American Triple Purpose, m.d. on arm

UPRIGHT DRILLS

20" Barnes All Geared, m.d., tapper
21" Cincinnati-Bickford, m.d., tapper
24" Cincinnati-Bickford, m.d.
30" Rich H.D., m.d.
D4 Colburn H.D., m.d.
D8 Colburn H.D., m.d.
No. 25 Foote-Burt, m.d.
No 36HO Baker, H.D., m.d.
No. 217 Baker H.D., s.p.d.

GEAR SHAPERS

No. 6 Fellows, belt drive
No. 7, 7A Fellows, m.d.
No. 18 Fellows, Gear Finishing Machine, m.d.
No. 61 Fellows, belted, m.d.
No. 61A Fellows, m.d., latest type
No. 64 S Fellows, m.d.
No. 615A Fellows, m.d.
No. 645 Fellows, belt drive
No. 645A3 Fellows, m.d., latest

GEAR GRINDERS

9" Pratt & Whitney Hydraulic Spur, m.d.
10" Pratt & Whitney Hydraulic Spur and Helical, m.d.
No. 2HS Lees-Bradner Spur and Helical, m.d.
No. 13LS Fellows Gear Lapper, m.d.

AUTOMATICS

8 spindle 1⅝" Cone, m.d., latest
4 spindle ⅞" Cleveland, Model M, m.d.
4 spindle 1¼" Conomatic, m.d., bar, 1942 machine
No. 5D2—12" Potter & Johnston, m.d., air chucks, 1944 machine
No. 5D2—15" Potter & Johnston, m.d., air chucks, 1944 machine
No. 6A Potter & Johnston, m.d.
No. 6C Potter & Johnston, m.d.
14" Fay, Flanders Type, m.d.
20x25" Jones & Lamson, m.d., latest
4 spindle ⅞" Model R-4 Acme-Gridley, m.d.
4 spindle 2¼" Cleveland Model "K", m.d.
2¼" Gridley Single Spindle, m.d.
2½" Cleveland Model A, m.d.
4¼" Cleveland Model A, m.d.
4½" Cleveland Model A, m.d.
5½" Cleveland Model A, m.d.
6" Cleveland Model A, m.d.
7¾" Cleveland Model A, m.d.

HORIZONTAL BORING MILLS

No. 0 Giddings & Lewis, m.d., 3⅛" bar
2½" Cleveland, m.d.
No. 25T Giddings & Lewis, m.d., 2½" bar, latest
No. 31 Lucas, 3" bar, m.d.
No. 33 Lucas, 4½" bar, m.d.
No. 45 Giddings & Lewis, m.d., 5" bar
4" bar Detrick & Harvey Floor Type, m.d.
5½" bar Niles, m.d.
10" bar Sellers Floor Type, m.d.

VERTICAL BORING MILLS

24" Bullard New Era, m.d., with side head
36" Bullard Spiral Drive, m.d., with side head
36" Bullard New Era, m.d., with side head
42" Bullard New Era, m.d., with side head
42" Bullard Spiral Drive, m.d., with side head
42" Colburn H.D., m.d., 2 swivel heads
48" Cincinnati Rapid Production, m.d., 1 turret head, 1 swivel head
48" Colburn H.D., m.d., 1 turret, 1 swivel head
48" Putnam H.D., m.d, 2 swivel heads
54" Colburn, md., 1 turret, 1 swivel head
84" Niles H.D., m.d., 2 swivel heads, p.r.t.
100" Niles Heavy, md., 2 swivel heads, p.r.t.
120" Niles Heavy, md., 2 swivel heads

We carry an average stock of 2,000 machines. Let us quote on your requirements.

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LATEST TYPE MACHINE TOOLS

BUILT AFTER 1941
ALL TIMKEN BEARING

MONARCH 12" x 30", 12" x 54" centers Model CK Toolmakers Lathe
GLEASON 3" and 12" straight bevel gear generator
MONARCH 10 x 20 Model EE Toolmakers Lathe
GRAY 36 x 36 x 8' Planer; "maximum service," motor drive
BROWN & SHARPE No. 1, 2 Universal Grinding Machine
LUCAS No. 41 Horizontal Boring, Milling and Drilling Machine—High Speed, motor drive

SELECTED FROM OUR STOCK OF MORE THAN 2000 DEPENDABLE MACHINE TOOLS

Send Us Your Specific Inquiry. Every Machine Carries Our Money-Back Guarantee

MOREY MACHINERY CO., INC.
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NEW YORK 13, N. Y.

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GET "LIKE NEW" PERFORMANCE WITH CIMCO TOOLS

SPECIAL
No. 3—12 Arter Surface Grinder

BORING MILLS
24" & 36" Bullard 'New Era'
34" King Boring Mill

GEAR CUTTERS AND HOBBERS
No. 2 Pfauter Gear Hobber, B.D.
No. 12 Barber-Colman, M.D.
No. 3—26 Brown & Sharpe, M.D.
3"—11" Gleason Gear Generator
2—No. 3—36" B & S Gear Cutters
1—48" G & E Gear Cutter

DRILLS
2½" to 7" Plain Radial Drills

LATHES

18" x 54" centers, Lodge & Shipley, Late type, Lathe

16" x 8' Carroll-Jamieson Grd. Hd. New
10" Rivett Bench Lathe
14" x 6" LeBlond Geared Head Screw Cut, Eng. Lathe
16" x 8' American Geared Head Screw Cut, Eng. Lathe
36 x 36 American Geared Head Screw Cut, Eng. Lathe

GRINDERS
1—No. 72-A3 Heald Internal Grinder, late type
1—No. 72-A5 Heald Internal Grinder, late type
10" x 24" Landis Universal, late type
10" x 48" Norton Plain, late type
14" x 36" Landis Plain, late type
16" x 96" Landis Universal, late type
14" x 72" G & L Surface, late type
120 A 51 Gardner Opposed Wheel Grinder
124—53" Gardner Horizontal Disc Grinder

GOULD & EBERHARDT 36 R AUTO. RACK CUTTER

MILLERS

No. 3 CINCINNATI PLAIN MILLER, LATE TYPE

No. 12 Brown & Sharpe, Plain
3 S Cincinnati, Plain
No. 4 Cincinnati Plain, Rect. O.A.
No. 3A & No. 4A Brown & Sharpe Universal

PLANERS
24" x 24" x 8' Liberty Openside Planer
30" x 30" x 12' Liberty Openside Planer
112" x 76" x 28' Convertible Planer
120" x 120" x 20' Liberty Double Housing Planer

GUARANTEED MACHINERY

Many other tools of various sizes and types.

Cincinnati Machinery Company Incorporated
239 E. SECOND STREET
CINCINNATI 2, OHIO

QUALITY TOOLS

GEAR MACHINERY
Nos. 3, 12 and Type T Barber-Colman
Nos. 8H, 12H and 16HS Gould & Eberhardt
Nos. 1, 5A and 5AC Lees-Bradner
No. 130 Cleveland Rigid hobber
10" Pratt & Whitney gear grinder
12" Red Ring gear shaver
No. 5M Adams Mfg. hobber

RADIAL DRILLS
3' Morris
4' Hammond sensitive
4' Cincinnati Bickford universal
4' American triple purpose
6' Dreses
6' Cincinnati Bickford
7' American triple purpose

SURFACE GRINDERS
24" x 48" Springfield planer type
14" x 60" Mattison hydraulic
12" x 40" Thompson hydraulic
10" x 24" Norton hydraulic
Nos. 3 and 34 Abrasive
12" and 16", No. 22 Heald rotary
16" and 24", No. 25A Heald rotary
16", No. 11 Blanchard rotary
30", No. 16 Blanchard rotary
14" x 36" Pratt & Whitney vertical
8" Pratt & Whitney tub type
Model DA Walker single stroke

TURRET LATHES
Warner & Swasey, Nos. 2, 3, 4, 5, 1A and 3A
Gisholt, Nos. 3, 4 and 3AL, 28"
Bardons & Oliver, Nos. 3 and 5
Jones & Lamson, 3" x 36" and 4" x 34"
Bullard, 24" and 42" vertical
Foster, No. 2FU Fastermatic

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MILES MACHINERY COMPANY
SAGINAW, MICH.

PORTABLE HEATER SALE **IMMEDIATE DELIVERY**

STEWART-WARNER PORTABLE POWERFUL 100,000 BTU GASOLINE-BURNING HEATERS COMPLETE WITH TURBINE TYPE BLOWER AND 1½ HP. AIR-COOLED BALL-BEARING ENGINE.

Portable Self-Powered Many-Purpose Heater

Ideal for Machine Shops, Factories, etc.

HEATING buildings, shops, sheds, warehouses, manholes, tunnels, buildings under construction, spot-heating, etc.

PRE-HEATING engines, tractors, trucks, equipment, etc.

THAWING frozen areas, machinery, pipe lines, tanks, etc.

DRYING plaster, paint, mortar, concrete, etc.

ORIGINAL COST .....over $600.00

SALE PRICE.....$195.00 Prepaid

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THESE NEW IN 1941 OR LATER

MILLS
No. 0-8 CINN. Plain
No. 0-8 CINN. Vertical, Rotary Table
No. 2MH CINN. Universal—also Plain
*No. 1-18 CINN. Production
No. 18 CINN. Mill Mfg.
No. 2H K&T Universal Horizontal
No. 2HL K&T Vertical
No. 4K K&T Plain, Like New
No. 4K K&T Vertical Boring Head
M-24 K&T Production Mill

RADIAL DRILLS
*4' AMERICAN
No. 368—6' HAMMOND

ENGINE LATHES
18" x 12' AMERICAN Pacemaker
16" x 36" BRADFORD
16" x 10' CARROLL-JAMIESON
18" x 48" CENTURY
*9" x 18" HARDINGE
16" x 6' NEW SEBASTIAN, TA MIB
8½" x 40" RIVETT

TURRET LATHES
No. 5 BARDONS & OLIVER
No. 4 MIDLAND
No. 3 GISHOLT Chucking Machine
No. 4 GISHOLT Chucking Machine
No. 5 GISHOLT Bar Feed
*No. 1A W&S Preselect Head

AUTOMATIC
1⅝" GREENLEE 6 spindle, tooling, excellent condition.

HEADERS
¼" x 2" New DSSD—Mar. Del.

CRANKSHAFT LATHES
24" x 25" CRANKSHAFT CBF-2
36" x 48" LEBLOND

GRINDERS
No. 2 CINN. Centerless, Film Bearings
No. 3 CINN. Centerless, Film Bearings
6" x 30" CINN. Cyl. Plain, Film Bearings
PORTER-CABLE Belt Sander
12" x 36" x 40" THOMPSON Hyd. Type C, Like New

PUNCH PRESSES
No. 62 BLISS — No. 7G STANDARD
No. 62A BLISS — *No. 56 TOLEDO

MISCELLANEOUS
10" SUNDSTRAND Stub Lathes
No. 1-GED BAKEWELL Tapper
Type S BARBER-COLMAN Gear Hobber
*No. 3 BARBER-COLMAN Gear Hobber
No. H3 BARNES Hydram Drill
No. 305 BLISS Straight Side Press
1 B. & S. Screw Machine, Model 00G
48" x 48" GRAY Double Hous. Planers
3 No. 40 LEES-BRADNER Ring Type Thread Millers
No. 2A PRATT & WHITNEY Jig Borer

*Older than '41, but in Like New Condition.

Since 1906 **JOSEPH BEHR & SONS, Inc.**
1170 SEMINARY ST.
ROCKFORD, ILLINOIS

WANTED

10' x ½" press brake 8' x ½" gate shear
Cincinnati or equivalent.
State price and delivery.
Box No. 529, MACHINERY,
148 Lafayette St., New York 13, N. Y

FOR SALE—FEDERAL SPOT WELDER
Designed for welding aluminum up to .081 24ST to meet Army-Navy specifications. Complete with control panel. Cost today $12,000.00. Bargain.

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1207 Fulton Avenue San Antonio, Texas

MECHANICAL DESIGNER

With a minimum of five years' experience in heavy materials handling equipment. Able to do rapid, accurate design and detail work on ore bridges, cranes and whirlers. Write, giving resume of experience, education and salary desired. The Salary Personnel Manager, Dravo Corporation, Neville Island, Pittsburgh 25, Pa.

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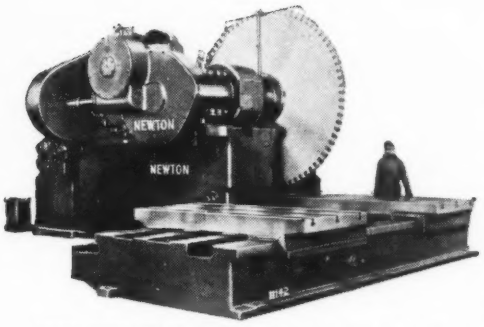
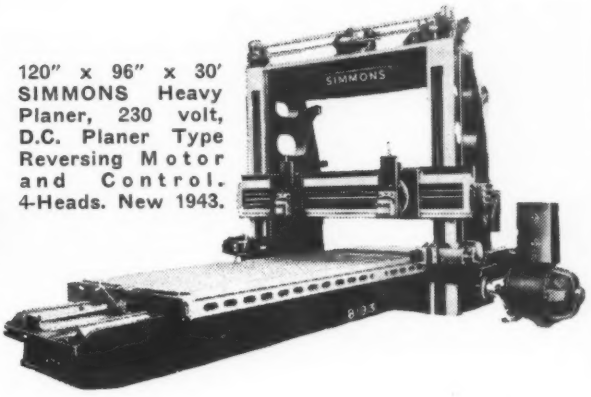
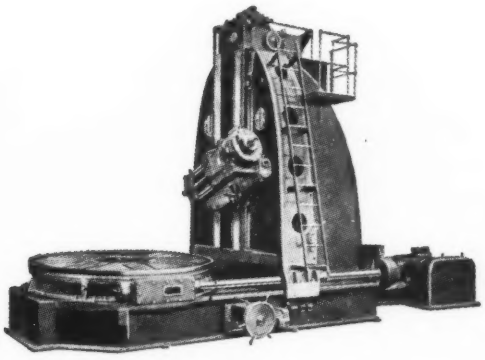


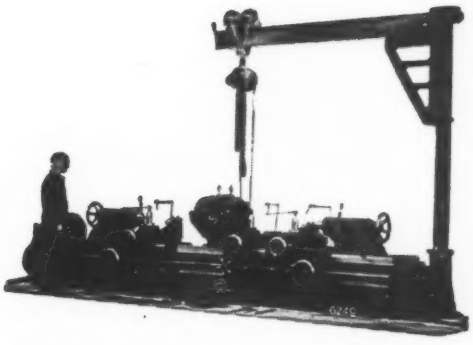
120" NEWTON Type U-97-A Cold Saw Cutting-Off Machine, hydraulic feed, cast steel work tables.

120" x 96" x 30' SIMMONS Heavy Planer, 230 volt, D.C. Planer Type Reversing Motor and Control. 4-Heads. New 1943.

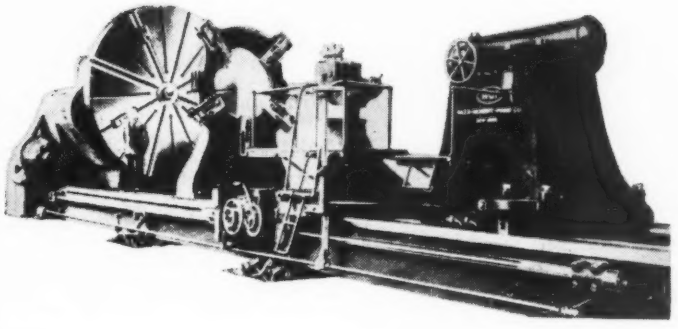




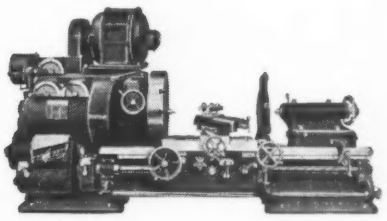
150" No. 2 MUIR Traveling Head Gear Hobber.



30/45" x 127" centers NILES Gap Type journal turning and axle lathe.



14' x 50' (34' centers) NILES SCREW CUTTING ENGINE LATHE. Power rapid traverse to carriage, compound rest. Arranged for motor drive.



42" and 48" AMERICAN, 16-speed Geared Head Engine Lathes.

SPECIFICATIONS:

Max. swing over ways	174"
Swing over carriage, gap piece out	153"
Swing over carriage, gap piece in	138"
Takes between centers, max.	408"
Steel spindle bearings, front	22"
Steel spindle bearings, rear	14"
Diameter of face-plate	144"
Face of steel internal driven gear	8"
Carriage bearing on ways	88"
Feeds 27; range per RPM	.010 to .400
Threading range	.100 to 4"
Steady rest range, dia.	28" to 50"
Tailstock bearing on bed	87" x 72"
Tailstock spindle—12"; adjustment	24"
Speed range, RPM	.233 to 23
Lead screw diameter	3⅞"

EQUIPMENT:

Main drive motor, power rapid traverse motor and motor for moving tailstock. Compound rest, four face-plate chuck jaws, steady rest.

Net weight, approx. (lbs.)	190,000
Boxed weight, approx. (lbs.)	210,000

Write today for Complete Current Stock List of Simmons *Engineered-Rebuilt* Machine Tools

SIMMONS MACHINE TOOL CORPORATION

MAIN OFFICE AND PLANT: 1600 N. BROADWAY, ALBANY 1, N. Y. NEW YORK OFFICE: 50 EAST 42ND STREET

ENGINEERED Machine Tool REBUILDING

PRODUCT INDEX

For addresses of manufacturers listed. consult advertisements in this and previous issue. Index Pages 401-402

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Carborundum Co.
Behr-Manning Corp., Div. Norton Co.
Walls Sales Corp.

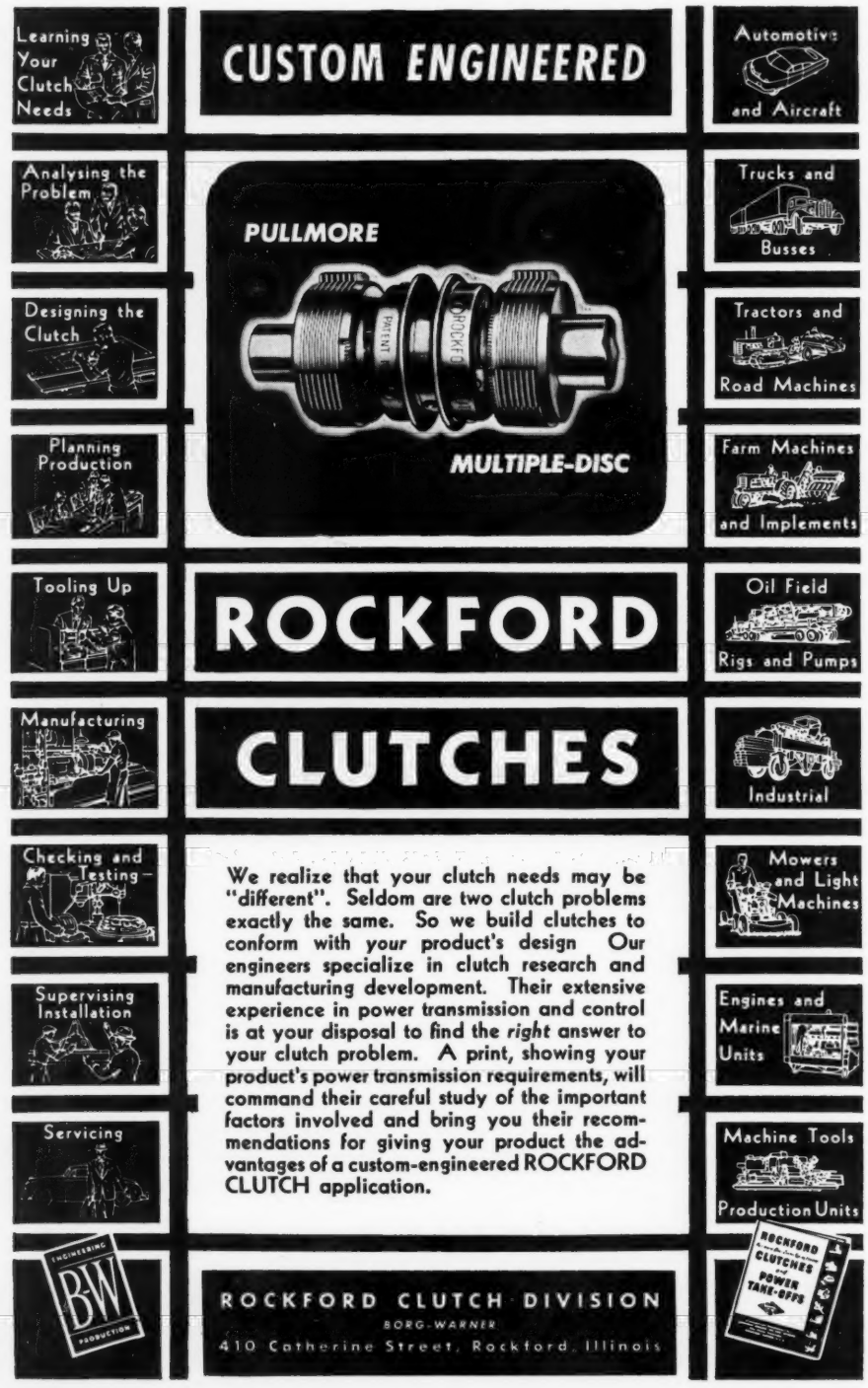
ABRASIVE DISCS
See Discs, Abrasive.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co.
Norton Co.

ACCUMULATORS, Hydraulic
Baldwin Locomotive Works
Bethlehem Steel Co.
Elmes Engineering Works
Farquhar, A. B., Co.
Farrel-Birmingham Co., Inc.
Hydropress Inc.
Lake Erie Engineering Corp.
Morgan Engineering Co.
Vickers, Inc.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic Drills, Portable Pneumatic, etc.


Learning Your Clutch Needs
CUSTOM ENGINEERED
Automotive and Aircraft
Analysing the Problem
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Designing the Clutch
Tractors and Road Machines
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Oil Field Rigs and Pumps
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CLUTCHES
Industrial
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We realize that your clutch needs may be "different". Seldom are two clutch problems exactly the same. So we build clutches to conform with your product's design Our engineers specialize in clutch research and manufacturing development. Their extensive experience in power transmission and control is at your disposal to find the right answer to your clutch problem. A print, showing your product's power transmission requirements, will command their careful study of the important factors involved and bring you their recommendations for giving your product the advantages of a custom-engineered ROCKFORD CLUTCH application.
Mowers and Light Machines
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Engines and Marine Units
Servicing
Machine Tools Production Units
ROCKFORD CLUTCH DIVISION
BORG-WARNER
410 Catherine Street, Rockford, Illinois

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Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Chambersburg Engineering Co
Ingersoll Steel Div., Borg-Warner Corp.
National-Erie Corp.
Republic Steel Corp.,
Union Drawn Steel Div.
Ryerson, Joseph T., & Son, Inc.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div.
Vanadium-Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

ALLOYS, Aluminum
Aluminum Co. of America

ALLOYS, Non-Ferrous
American Brass Co.
Haynes Stellite Co
Revere Copper & Brass, Inc.

ARBOR PRESSES
See Presses, Arbor.

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co.
Chicago-Latrobe Twist Drill Wks.
Cleveland Twist Drill Co.
Danly Machine Specialties, Inc.
Jacobs Manufacturing Co.
Kempsmith Machine Co.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney
Standard Tool Co.
Union Twist Drill Co.
Whitman & Barnes

BABBITT
Bunting Brass & Bronze Co.
Johnson Bronze Co.
Ryerson, Joseph T., & Son, Inc.

BALANCING EQUIPMENT
Anderson Bros. Mfg. Co.
Gisholt Machine Co.
(Static and Dynamic)
Pope Machinery Corp.
Snyder Tool & Engrg. Co.
Sundstrand Mch. Tool Co.
Westinghouse Electric Corp.

BALLS
Kennametal, Inc.
S K F Industries, Inc.

BARS, Boring
See Boring Bars.

BARS, Phosphor Bronze
Bunting Brass & Bronze Co.
Johnson Bronze Co.

BARS, Steel
Allegheny Ludlum Steel Corp
Bethlehem Steel Co.
Carpenter Steel Co.
Firth Sterling Steel & Carbide Corp.
Republic Steel Corp.,
Union Drawn Steel Div.
Ryerson, Joseph T., & Son, Inc.

Timken Roller Bearing Co.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.)
Vanadium-Alloys Steel Co.
Ward Steel Co.
Wheelock, Lovejoy & Co.

BASES, Machinery, Welded

Mahon, R. C., Co.

BEARINGS, Babbitt

Bunting Brass & Bronze Co.
Johnson Bronze Co.

BEARINGS, Ball

Aetna Ball & Roller Bearing Co.
Atlantic Gear Works, Inc.
Ball & Roller Bearing Co.
Bearings Co. of America
Boston Gear Works, Inc.
Fafnir Bearing Co.
Federal Bearings Co., Inc.
Gwilliam Co.
Nice Ball Bearing Co.
Norma-Hoffmann Bearings Corp.
S K F Industries, Inc.
Schatz Mfg. Co.
Torrington Co.

BEARINGS, Bronze and Special Alloy

American Brake Shoe Co.
Amplex Mfg. Co.
Bunting Brass & Bronze Co.
Haynes Stellite Co.
Johnson Bronze Co.

BEARINGS, Lineshaft

Fafnir Bearing Co.
S K F Industries, Inc.
Orange Roller Bearing Co., Inc.
Standard Pressed Steel Co.

BEARINGS, Needle

Norma-Hoffmann Bearings Corp.
Orange Roller Bearing Co, Inc.
Torrington Co.

BEARINGS, Roller

Aetna Ball & Roller Bearing Co.
Fafnir Bearing Co.
Gwilliam Co.
Hyatt Bearings Div., General Motors Corp.
Norma-Hoffmann Bearings Corp.
Orange Roller Bearing Co., Inc.
Rollway Bearing Co., Inc.
S K F Industries, Inc.
Timken Roller Bearing Co.
Torrington Co.

BEARINGS, Self-Lubricating (Oilless)

Amplex Mfg. Co.
Arguto Oilless Bearing Co.
Bunting Brass & Bronze Co.
Johnson Bronze Co.
Raybestos-Manhattan, Inc., Manhattan Rubber Div.

BEARINGS, Tapered Roller

Raybestos-Manhattan, Inc., Manhattan Rubber Div.
Timken Roller Bearing Co.
Torrington Co.

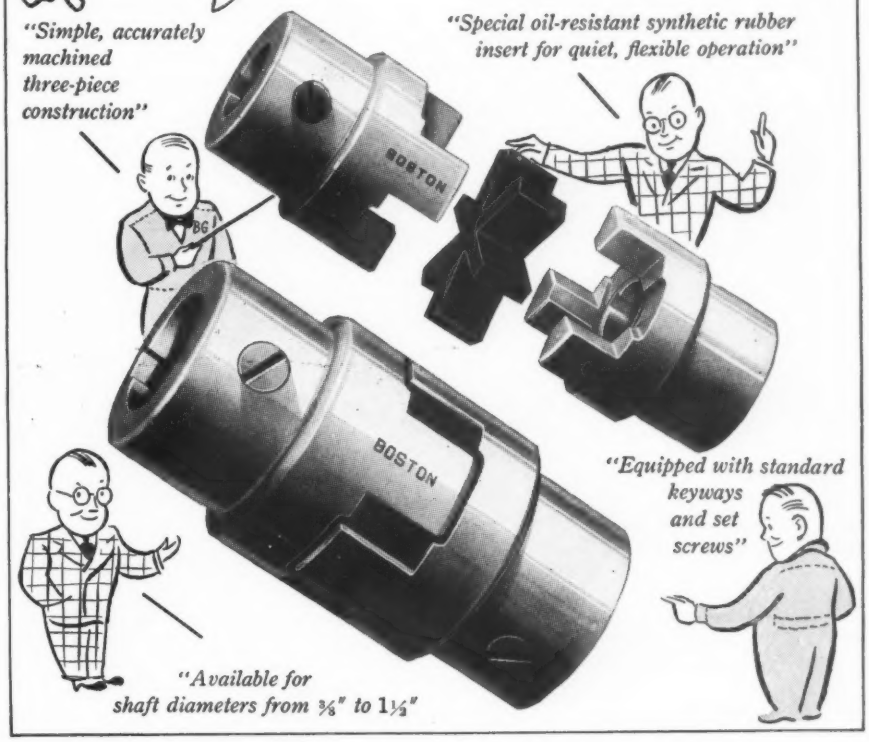
BEARINGS, Thrust

Aetna Ball & Roller Bearing Co.
Atlantic Gear Works, Inc.
Ball & Roller Bearing Co.
Bearings Co. of America
Boston Gear Works, Inc.
Bunting Brass & Bronze Co.

(Continued on page 370)

NEW COUPLING by Boston Gear

"BE SURE YOUR NEXT COUPLINGS HAVE ALL THESE FEATURES . . ."


"Simple, accurately machined three-piece construction"
"Special oil-resistant synthetic rubber insert for quiet, flexible operation"
BOSTON
BOSTON
"Equipped with standard keyways and set screws"
"Available for shaft diameters from ⅜" to 1½"

BRAND NEW DESIGN . . . These new Boston Gear Couplings are designed for quick, simple installation and long, trouble-free service without attention. Completely, accurately machined, they are intended for a wide range of industrial applications where *flexibility*, *ruggedness* and *durability* are required. These couplings require no lubrication and are not harmed by oil, dust or dirt.

AVAILABLE IMMEDIATELY FROM STOCK! There's a Boston Gear Distributor within fast shipping time of your plant who can supply you with these new couplings. Write for complete list of authorized distributors — or see our alphabetical listing in THOMAS' REGISTER for your nearest distributor.

FREE! Get this folder on Boston Gear's new flexible couplings

Name ..... Position .....

Company .....

Address .....

City ..... Zone . State .....

One of the world's most complete lines
71 distributors in major cities

BOSTON GEAR WORKS
56 Hayward St., Quincy 71, Mass.

DART LEADERSHIP

is based on these *Proven Advantages*

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The two seats in each Dart Union are spherical-ground to form a *true ball joint* that's drop-tight and leak-proof.

PROPER ALLOYS

Both seats are made of bronze—which means they're *non-corroding* ...longer lasting.

TROUBLE-FREE DESIGN

Darts close without damage, jamming, or excessive wrenching. Body and nut are made of high-test, air-refined malleable iron . . . practically indestructible.

For these and other Dart advantages, order *today* from your supplier.

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General Mfg. Co.
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Buffalo Forge Co.
Chambersburg Engineering Co.
Farquhar, A. B., Co.
Hannifin Corp.
Hydraulic Press Mfg. Co.
Lake Erie Engineering Corp.
Morgan Engineering Co.

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Bethlehem Steel Co.
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Industrial Press
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- ...rnes, W. F. & John, Co.
- ...llard Company
- ...nsolidated Mch. Tool Corp.
- ...sa Corp.
- ...ote-Burt Co.
- ...gersoll Milling Mch. Co.
- ...night, W. B., Mchry. Co.
- Moline Tool Co.
- National Acme Co.
- ...ational Automatic Tool Co.
- ...nyder Tool & Engrg. Co.

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- ...ullard Company
- ...osa Corp.
- ...nyder Tool & Engrg. Co.

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- ...llard Company
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- ...rth Sterling Steel & Carbide Corp.
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- ...airing Tool Co.

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- ...eald Machine Co.
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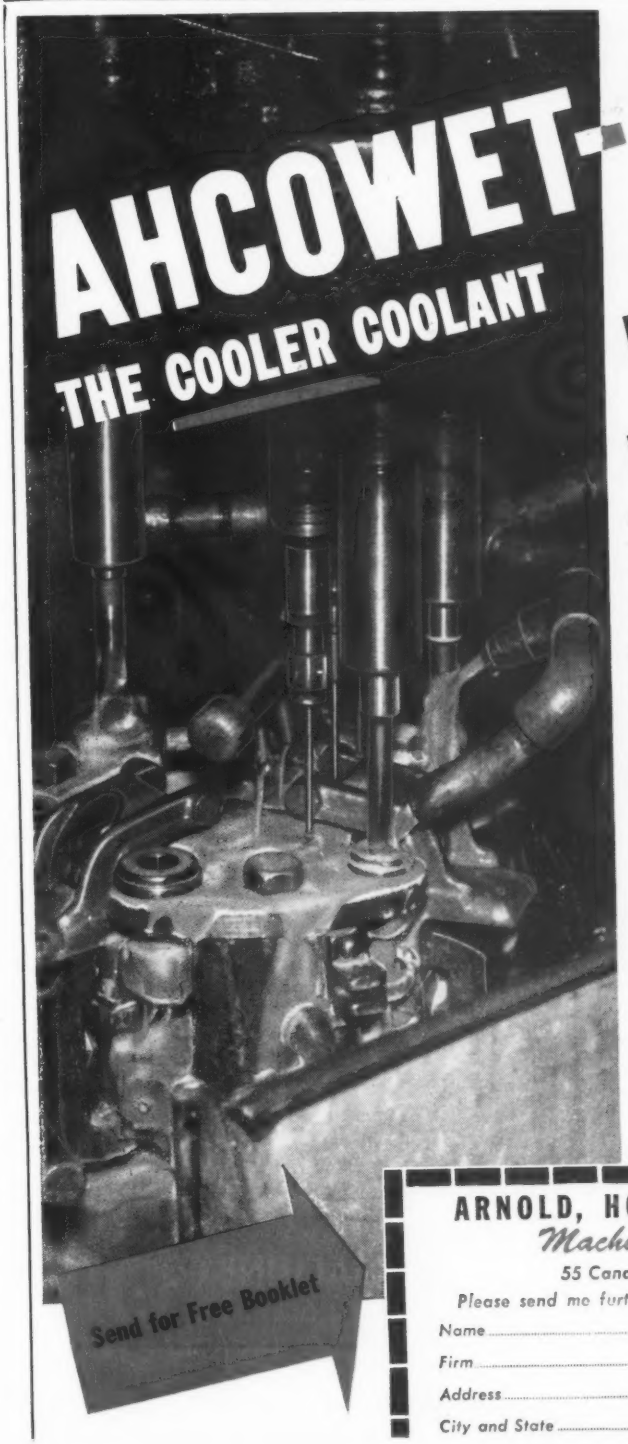

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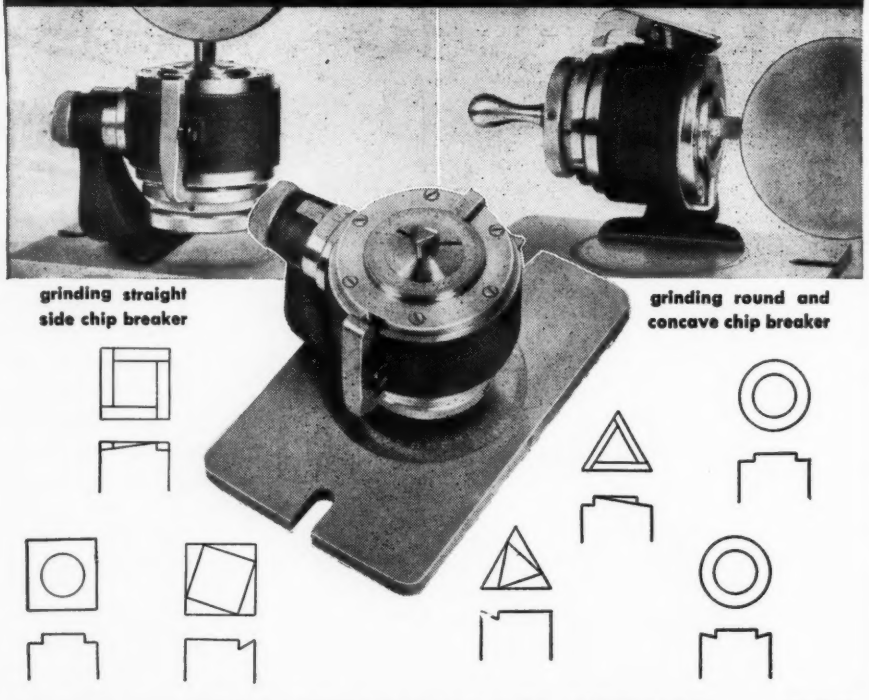

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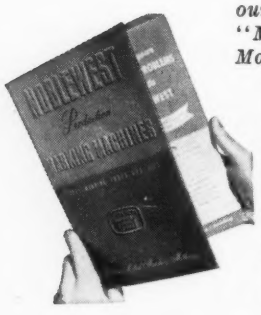

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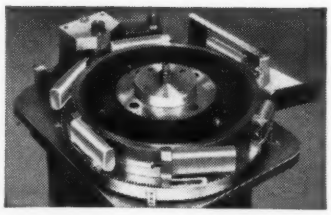

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(Continued on page 376)

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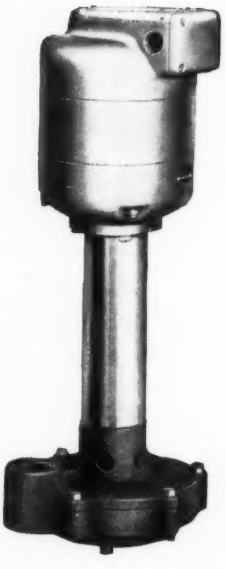

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Williams, J. H., & Co.

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Ingersoll Milling Mch. Co.
Moline Tool Co.
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Motch & Merryweather Mchry. Co.
Ryerson, Joseph T., & Son, Inc.
Simmons Machine Tool Corp.

DEMAGNETIZERS
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Blanchard Mch. Co.
Heald Machine Co.
Walker, O. S., Co., Inc.

DESIGNERS, Machine and Tool
Ex-Cell-O Corp.
Hartford Special Mchry. Co.
Pratt & Whitney
Snyder Tool & Engrg. Co
Sundstrand Machine Tool Co.

DIAMONDS and Diamond Tools
Smit, J. K., & Sons, Inc.

DIE CASTING MACHINES
Cleveland Automatic Machine Co.
Hydraulic Press Mfg. Co.
Kux Machine Co.

DIE CASTING
See Castings, Die.

DIE CUSHIONS
Bliss, E. W., Co.
Clearing Mch. Corp.
Rogers, Dayton, Mfg. Co.
Verson Allsteel Press Co.

DIE INSERTS, Carbide
Allegheny Ludlum Co.
Carboloy Co., Inc.
Firth Sterling Steel & Carbide Corp.
Kennametal, Inc.
Metal Carbides Corp.

DIE MAKERS' SUPPLIES
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Baumbach, E. A., Mfg. Co.
Danly Mch. Specialties, Inc.
U. S. Tool Company, Inc.

DIE MAKING MACHINES
Grob Brothers
Kearney & Trecker Corp.
Oliver Instrument Co.

DIE SETS, Standard
Baumbach, E. A., Mfg. Co.
Danly Mch. Specialties, Inc.
Pratt & Whitney

DIE SINKING MACHINES
Cincinnati Milling Mch. Co.
Gorton, George, Mch. Co.
Pratt & Whitney

DIE SINKING PRESSES
Baldwin Locomotive Works
Kearney & Trecker Corp.

DIE STOCKS
See Stocks, Die.

DIES, Lettering and Embossing
Noble & Westbrook Mfg. Co.

DIES, Sheet Metal, Etc.
Allied Products Corp.
Baumbach, E. A., Mfg. Co.
Bliss, E. W., Co.
Carboloy Co.
Columbus Die, Tool & Mch. Co.
Ferracute Machine Co.
Ford, M. A., Mfg. Co.
Metal Carbides Corp.
Niagara Mch. & Tool Works
Taft-Peirce Mfg. Co.
V & O Press Co.
Verson Allsteel Press Co.
Waltham Machine Works, Inc.

DIES, Threading
Butterfield Div., Union Twist Drill Co.
Card, S. W., Mfg. Co.
Eastern Mch. Screw Corp.
Geometric Tool Co.
Greenfield Tap & Die Corp.
Hill Acme Co.
Morse Twist Drill & Mch. Co.
Murchey Machine & Tool Co., Div. Sheffield Corp.
National Acme Co.
Pratt & Whitney
Standard Tool Co.
Threadwell Tap & Die Co.
Winter Bros. Co.

DIES, Threading, Opening
Eastern Mch. Screw Corp.
Errington Mechanical Laboratory
Geometric Tool Co.
Hill Acme Co.
Jones & Lamson Mch. Co.
Landis Mch. Co.
Murchey Machine & Tool Co., Div. Sheffield Corp.
National Acme Co.
Sheffield Corp.

DIES, Thread Rolling
Pratt & Whitney

DISCS, Abrasive
Besly, Chas. H., & Co.
Carborundum Co.
Gardner Machine Co.
Norton Co.
Ravbestos-Manhattan, Inc., Manhattan Rubber Div

(Continued on page 378)

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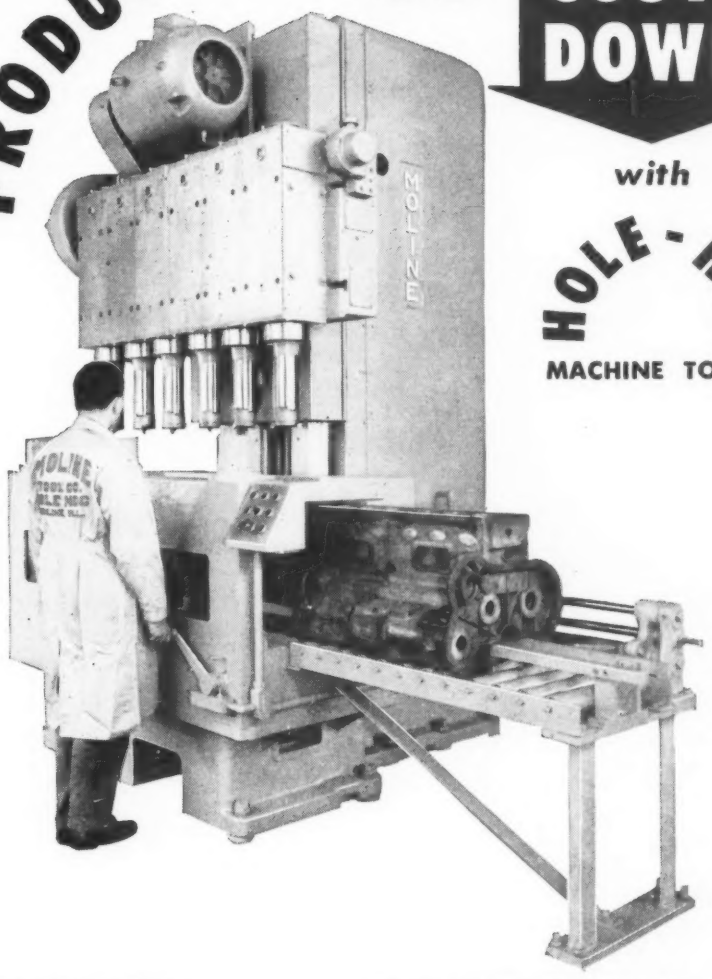

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Super Tool Co.

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Morse Twist Drill & Mch. Co.
Whitman & Barnes

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Errington Mechanical Laboratory
Ettco Tool Co.
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Langelier Mfg. Co.
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Thrittmaster Products Corp.
United States Drill Head Co

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Rehnberg-Jacobson Mfg. Co.
Snow Mfg. Co.

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Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co
Union Twist Drill Co.
Standard Tool Co.
Whitman & Barnes

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Bodine Corp.
Consolidated Mch. Tool Corp.
Kingsbury Mch. Tool Corp.
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National Automatic Tool Co.
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Says
CHIP WRIGHT

"Looking for trouble is a necessary part of efficient operation, because the most efficient shop is one in which troubles are reduced to a minimum.

"A plant honing cylinder blocks was considered to be trouble-free when it was averaging 9.6 blocks per stone and getting a fair finish. However, when a change of honing oil made it possible to hone 15.4 blocks per stone and get a better finish, it was realized that there actually had been *trouble* before this profitable change was made.*

"That's what I mean when I say, 'Let's look for trouble.' Another way of stating it is: 'Where can we find opportunity for improvement?' Frequently the biggest single opportunity lies in the choice of cutting fluids."

—Chip

*The change that improved the honing operation cited above was a mixture of ThredKut 99 recommended by a D. A. Stuart Oil Co. representative. ThredKut 99 is easily mixed or blended whenever a special operation calls for its unusual qualities. Ask for a booklet on D. A. Stuart's ThredKut 99 and other time-tested cutting fluids.

STUART oil engineering goes with every barrel

D. A. Stuart Oil Co.

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- Elgin Tool Works, Inc.
- Fosdick Mch. Tool Co.
- Henry & Wright Mfg. Co.
- Langelier Mfg. Co.
- Leland-Gifford Co.
- South Bend Lathe Works, Inc.
- Walker-Turner Div., Kearney & Trecker Corp.

DRILLING MACHINES, Boiler
- Cincinnati Bickford Tool Co.
- Foote-Burt Co.

DRILLING MACHINES, Deep Hole
- Pratt & Whitney
- Leland-Gifford Co.

DRILLING MACHINES, Gang
- Baker Brothers, Inc.
- Barnes Drill Co.
- Baush Machine Tool Co.
- Bryant Machinery & Engineering Co.
- Cincinnati Bickford Tool Co.
- Consolidated Mch. Tool Corp.
- Delta Mfg. Div., Rockwell Mfg. Co.
- Foote-Burt Co.
- Fosdick Mch. Tool Co.
- Ingersoll Milling Mch. Co.
- Langelier Mfg. Co.
- Leland-Gifford Co.
- Moline Tool Co.
- National Automatic Tool Co.
- Snyder Tool & Engrg. Co.

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- Barnes Drill Co.
- Barnes, W. F. & John, Co.
- Baush Machine Tool Co.
- Consolidated Mch. Tool Corp.
- Davis & Thompson Co.
- Kingsbury Mch. Tool Corp.
- Langelier Mfg. Co.
- Murchey Machine & Tool Co., Div. Sheffield Corp.
- Snow Mfg. Co.
- Snyder Tool & Engrg. Co.
- National Automatic Tool Co.
- Sundstrand Mch. Tool Co.

DRILLING MACHINES, HORIZONTAL, Portable
- Cincinnati Bickford Tool Co.

DRILLING MACHINES, Inverted
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- Barnes Drill Co.
- Baush Machine Tool Co.
- Snyder Tool & Engrg. Co.

DRILLING MACHINES, Multiple Center Column Type
- Barnes Drill Co.

DRILLING MACHINES, Multiple Spindle
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- Barnes, W. F. & John, Co.
- Baush Machine Tool Co.
- Bryant Machinery & Engineering Co.
- Buffalo Forge Co.
- Cincinnati Bickford Tool Co.
- Cross Co.
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- Delta Mfg. Div., Rockwell Mfg. Co.
- Fosdick Mch. Tool Co.
- Greenlee Bros. & Co.
- Henry & Wright Mfg. Co.
- Ingersoll Milling Mch. Co.
- Kingsbury Mch. Tool Corp.
- Langelier Mfg. Co.
- Leland-Gifford Co.
- Le Maire Tool & Mfg. Co.
- Moline Tool Co.
- National Automatic Tool Co.
- Pratt & Whitney
- Snow Mfg. Co.
- Snyder Tool & Engrg. Co.
- Taylor & Fenn Co.

DRILLING MACHINES, Radial
- American Tool Works Co.
- Carlton Machine Tool Co.
- Cincinnati Bickford Tool Co.
- Foote-Burt Co.
- Fosdick Mch. Tool Co.

DRILLING MACHINES, Rail

See Drilling Machines, Gang.

DRILLING MACHINES, Sensitive
- Buffalo Forge Co.
- Delta Mfg. Div., Rockwell Mfg. Co.
- Foote-Burt Co.
- Fosdick Mch. Tool Co.
- Henry & Wright Mfg. Co.
- Langelier Mfg. Co.
- Leland-Gifford Co.
- National Automatic Tool Co.
- Pratt & Whitney
- Ryerson, Joseph T., & Son, Inc.
- Snow Mfg. Co.
- Taylor & Fenn Co.

DRILLING MACHINES, Upright
- Baker Brothers, Inc.
- Barnes Drill Co.
- Barnes, W. F. & John, Co.
- Baush Machine Tool Co.
- Bryant Machinery & Engineering Co.
- Buffalo Forge Co.
- Cincinnati Bickford Tool Co.
- Consolidated Mch. Tool Corp.
- Delta Mfg. Div., Rockwell Mfg. Co.
- Ex-Cell-O Corp.
- Foote-Burt Co.
- Fosdick Mch. Tool Co.
- Ingersoll Milling Mch. Co.
- Kingsbury Mch. Tool Corp.
- Langelier Mfg. Co.
- Leland-Gifford Co.
- Moline Tool Co.
- National Automatic Tool Co.
- Rehnberg-Jacobson Mfg. Co.
- Ryerson, Joseph T., & Son, Inc.
- Snow Mfg. Co.
- Snyder Tool & Engrg. Co.

DRILLING MACHINES, Wall Radial
- Cleveland Punch & Shear Works Co.
- Consolidated Mch Tool Corp.

DRILLS, Center
- Chicago-Latrobe Twist Drill Wks.
- Cleveland Twist Drill Co.
- Gairing Tool Co.
- Greenfield Tap & Die Corp.
- Morse Twist Drill & Mch. Co.
- National Twist Drill & Tool Co.
- Standard Tool Co.
- Union Twist Drill Co.
- Warner & Swasey Co.
- Whitman & Barnes

DRILLS, Core
- Carboloy Co., Inc.
- Chicago-Latrobe Twist Drill Wks.
- Ex-Cell-O Corp.
- Firth Sterling Steel & Carbide Corp.
- Gairing Tool Co.
- Haynes Stellite Co.
- Kelly Reamer Co.
- Morse Twist Drill & Mch. Co.
- National Twist Drill & Tool Co.
- Standard Tool Co.
- Super Tool Co.
- Union Twist Drill Co.
- Whitman & Barnes

DRILLS, Deep Hole
Conner Tool & Cutter Co.
Pratt & Whitney

DRILLS, Portable Electric
Buckeye Tools Corp.
Chicago Pneumatic Tool Co.
Cincinnati Electric Tool Co.
Dumore Co.
Ryerson, Joseph T., & Son, Inc.

DRILLS, Portable Pneumatic
Buckeye Tools Corp.
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Rotor Tool Co.

DRILLS, Ratchet
Armstrong Bros. Tool Co.
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Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney
Standard Tool Co.
Union Twist Drill Co.
Whitman & Barnes

DRILLS, Twist
Ampco Twist Drill Co.
Chicago-Latrobe Twist Drill Wks.
Cleveland Twist Drill Co.
Firth Sterling Steel & Carbide Corp.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Tool Salvage Co.
National Twist Drill & Tool Co.
Pratt & Whitney
Standard Tool Co.
Super Tool Co.
Union Twist Drill Co.
Whitman & Barnes

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Chicago-Latrobe Twist Drill Wks.
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EMERY WHEEL DRESSERS
See Dressers, Grinding Wheel.

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FILES, Machine
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(Continued on page 382)

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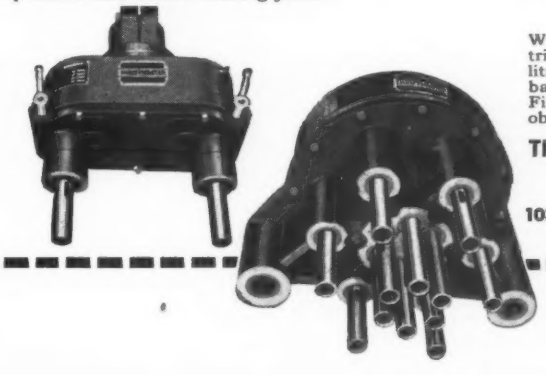

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National Machinery Co.

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FORGINGS, Hollow Bored
American Hollow Boring Co.
Bethlehem Steel Co.
National Forge & Ordnance Co.

FORGINGS, Iron and Steel
Bethlehem Steel Co.
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FORGINGS, Manganese, Bronze, Etc.
Baldwin Locomotive Works

FORGINGS, Upset
American Brake Shoe Co.
Bethlehem Steel Co.
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General Electric Co.
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Van Keuren Co.

GAGES, Air
Merz Engineering Co.
Pratt & Whitney
Sheffield Corp.

GAGES, Comparator
Ames, B. C., Co.
Federal Products Corp.
Jones & Lamson Machine Co.
Pratt & Whitney
Scherr, George, Co., Inc.
Sheffield Corp.
Standard Gage Co., Inc.
Taft-Peirce Manufacturing Co.
Woodworth, N. A., Co.

GAGES, Depth
Ames, B. C., Co. (dial)
Brown & Sharpe Mfg. Co.
Federal Products Corp.
Scherr, George, Co., Inc.
Standard Gage Co., Inc.
Starrett, L. S., Co.

GAGES, Dial
Ames, B. C., Co.
Bristol Co.
Brown & Sharpe Mfg. Co.
Federal Products Corp.
Scherr, George, Co., Inc.
Sheffield Corp.
Standard Gage Co., Inc.
Starrett, L. S., Co.

GAGES, Electric
Merz Engineering Co.
Pratt & Whitney
Sheffield Corp.

GAGES, Height
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Brown & Sharpe Mfg. Co.

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SMALL PARTS, TOOLS & DIES
In Your Own Plant

SAVE TIME AND MONEY
with these Versatile Cooley Electric Box Furnaces

- Install anywhere by simple wire connection. Quiet in operation. No fumes or odors—no ventilating required.
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- Operating cost under 4¢ per hour to hold 1600° F. in Model 3 furnaces, with 2¢ per kw.-hr. rate. Others in proportion.

NOW YOU CAN heat treat, harden and temper small parts in your own plant . . . *without experienced heat treaters.* Economical to install and use, Cooley Electric Furnaces operate efficiently at high or low heats, and save your large furnace time for work requiring large volume capacity. Here are some profitable uses:

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VK-5 FURNACE WITH CONTROL PANEL Complete factory wired assembly—furnace, stand, controls, fuses and multi-breaker switch ready for line connection. Saves installation time and insures correctly installed unit. Mobile; movable as a unit to new locations. Panel assembly available for all present furnaces.

CHAMBER	8"W 6"H 14"L				10"W 6"H 18"L				8"W 6"H 14"L	
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AMPERES	14.8 at 230 v.				19.6 at 230 v.				20.2 at 230 v.	
WATTS	3400				4500				4650	
MODEL*	MH-3	VH-3	MK-3	VK-3	MH-4	VH-4	MK-4	VK-4	VK-5	VK-6
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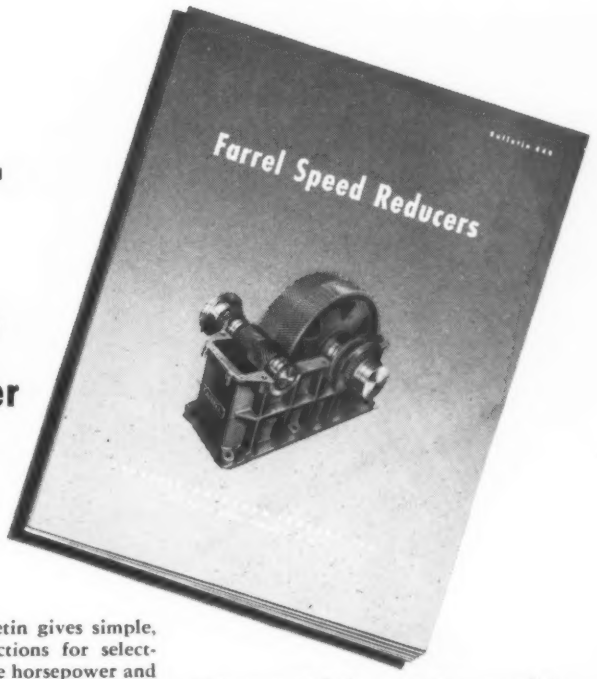

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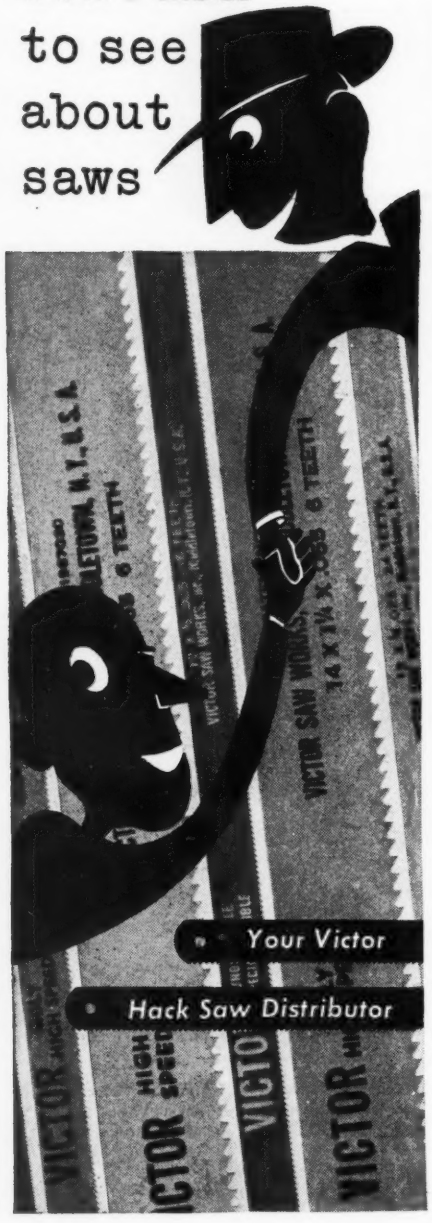

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GRINDING MACHINES, Crankshaft
Landis Tool Co.
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GRINDING MACHINES, Gap
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Moore Special Tool Co., Inc.
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Hill Acme Co.

GRINDING MACHINES, Piston Ring
Arter Grinding Machine Co.
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(Continued on page 386)

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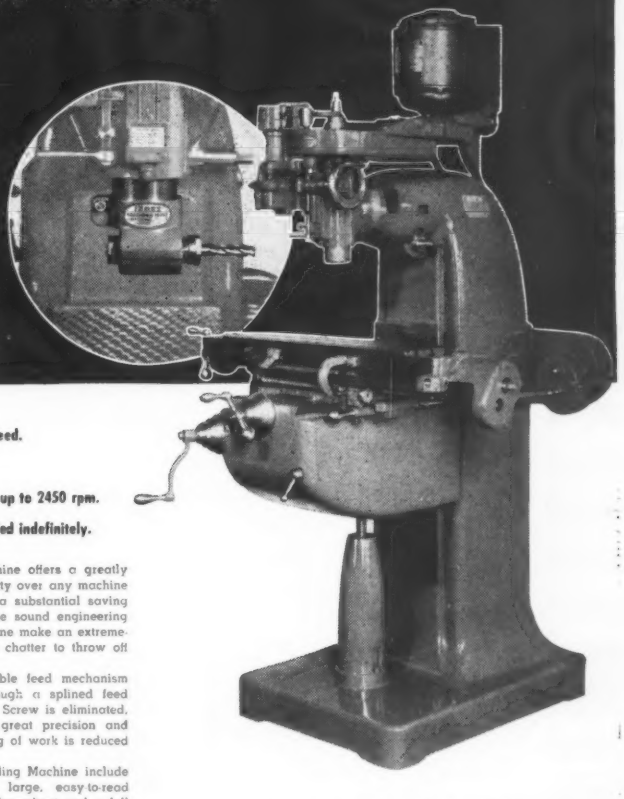
The new Index Angle-Milling Head accurately handles horizontal milling operations of every type including boring and drilling. Change over from vertical to angle milling takes only a few seconds and is done without disturbing the work on the machine table. The attachment can also be used as a cutting arbor or tool holder.



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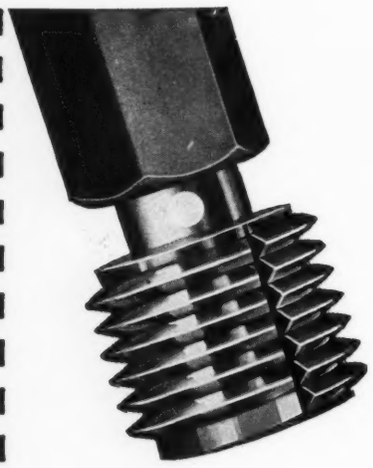

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Potter & Johnston Co.
Pratt & Whitney
Seneca Falls Mch. Co.
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LATHES, Axle
Consolidated Mch. Tool Corp.
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LeBlond, R. K., Mch. Tool Co.
Pratt & Whitney
Rivett Lathe & Grinder, Inc.
Seneca Falls Mch. Co.
Sheldon Mch. Co.
South Bend Lathe Wks.

LATHES, Boring
Gisholt Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Co.

LATHES, Crankshaft
Consolidated Mch. Tool Corp.
LeBlond, R. K., Mch. Tool Co.
Snyder Tool & Engrg. Co.
Sundstrand Mch. Tool Co.

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Cleveland Automatic Machine Co.
Consolidated Mch. Tool Corp.
LeBlond, R. K., Mch. Tool Co.
Snyder Tool & Engrg. Co.
Sundstrand Mch. Tool Co.

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Axelson Manufacturing Co.
Carroll-Jamieson Mch. Tool Co.
Cincinnati Lathe & Tool Co.
Clausing Manufacturing Co.
Consolidated Mch. Tool Corp.
Cosa Corp.
DoAll Co.
Greaves Machine Tool Co.
Hendey Machine Co.
LeBlond, R. K., Mch. Tool Co.
Lehmann Machine Co.
Lodge & Shipley Co.
Monarch Mch. Tool Co.
Morey Mchry. Co., Inc.
Pratt & Whitney
Rivett Lathe & Grinder, Inc.
Seneca Falls Mch. Co.
Sheldon Mch. Co.
Simmons Machine Tool Corp.
South Bend Lathe Wks.
Springfield Mch. Tool Co

LATHES, Form Turning
Monarch Mch. Tool Co.

LATHES, Gap
Cincinnati Lathe & Tool Co.
Gisholt Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Co.
Seneca Falls Mch. Co.
Warner & Swasey Co.

LATHES, Gun
Consolidated Mch. Tool Corp.
LeBlond, R. K., Mch. Tool Co.
Seneca Falls Mch. Co.
Springfield Mch. Tool Co.

LATHES, Hollow Spindle
LeBlond, R. K., Mch. Tool Co.
Lehmann Machine Co.

LATHES, Manufacturing Type
Lodge & Shipley Co.

LATHES, Spinning
Bliss, E. W., Co.
Ferracute Machine Co.

LATHES, Toolroom
See Lathes, Engine and Toolroom

LATHES, Turret
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Brown & Sharpe Mfg. Co.
Bullard Company
Gisholt Mch. Co. (Automatic)
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(Bench or Cabinet Mounting)
Jones & Lamson Mch. Co.
LeBlond, R. K., Mch. Tool Co.
Lodge & Shipley Co.
Morey Mchry. Co., Inc.
Potter & Johnston Co. (Automatic)
Rivett Lathe & Grinder, Inc.
Simmons Machine Tool Corp.
South Bend Lathes Wks.
Springfield Mch. Tool Co.
Warner & Swasey Co.

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Bullard Company

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Starrett, L. S., Co.
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Stuart, D. A., Oil Co., Ltd.
Sun Oil Co.
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Tide Water Associated Oil Co.

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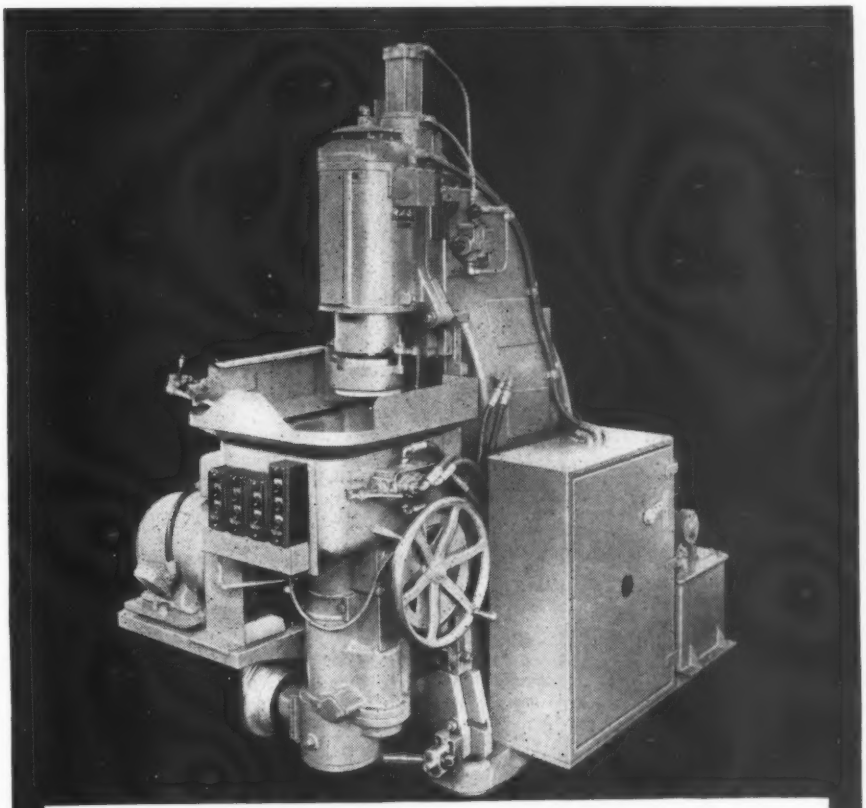
Manzel, Inc.
Rivett Lathe & Grinder, Inc.



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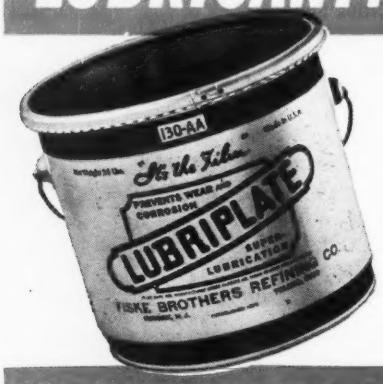

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Jones & Lamson Mch. Co. (Automatic)
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Consolidated Mch. Tool Corp.
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Kearney & Trecker Corp.
Snyder Tool & Engrg. Co.
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MILLING MACHINES, Die Sinking
See Die Sinking Machines.

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Consolidated Mch. Tool Corp.
Espen-Lucas Machine Works
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
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U. S. Tool Co., Inc.

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DoAll Co.
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Greaves Machine Tool Co.
Ingersoll Milling Mch. Co.
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Kempsmith Machine Co.
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Simmons Machine Tool Corp.
Snyder Tool & Engrg. Co.
Sundstrand Mch. Tool Corp.
Van Norman Co.

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Sundstrand Mch. Tool Corp.

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Espen-Lucas Machine Works
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Pratt & Whitney
Stokerunit Corp.

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Pratt & Whitney
Sundstrand Machine Tool Co.

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Van Norman Co.

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DoAll Co.
Gorton, George, Mch. Co.
Index Machine & Tool Co.
Ingersoll Milling Mch. Co.
Kearney & Trecker Corp.
Knight, W. B., Mchry. Co.
Pratt & Whitney
Snyder Tool & Engrg. Co.
Sundstrand Mch. Tool Co.
Taylor & Fenn Co.

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See Special Machinery Tools.

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Gorton, George, Mch. Co.
Pratt & Whitney

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Hydraulic Press Mfg. Co.

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Electro Machines, Inc.
General Electric Co.
Reliance Electric & Engrg. Co.
U. S. Electrical Motors, Inc.
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MOTORS, Hydraulic
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(Continued on page 392)

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duMont Corp.
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Wilson, K. R.

PRESSES, Broaching
American Broach & Mch. Co.
Bliss, E. W., Co.
Ferracute Machine Co.
Lapointe Machine Tool Co.
Oilgear Co.

PRESSES, Extrusion
Chambersburg Engineering Co.
Hydraulic Press Mfg. Co.
Hydropress, Inc.
Lake Erie Engineering Co.

PRESSES, Foot
Baird Machine Co.
Bliss, E. W., Co.
Ferracute Machine Co.
General Mfg. Co.
Niagara Machine & Tool Wks.
Taylor & Fenn Co.
V & O Press Co.

PRESSES, Forging
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Baldwin Locomotive Works
Bethlehem Steel Co.
Bliss, E. W., Co.
Clearing Mch. Co.
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Ferracute Machine Co.
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Anderson Bros. Mfg. Co.
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Bethlehem Steel Co.
Birdsboro Steel Fdry. & Mch. Co.
Bliss, E. W., Co.
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Hydropress, Inc.
Lake Erie Engineering Co.
Lapointe Machine Tool Co.
M & N Machine Tool Works, Inc.
Morgan Engineering Co.
National Erie Corp.
Oilgear Co.
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Wilson, K. R.

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Bliss, E. W., Co.
Ferracute Machine Co.
General Mfg. Co.
Niagara Machine & Tool Wks.
Zeh & Hahnemann Co.

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Bliss, E. W., Co.
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Cleveland Punch & Shear Works Co.
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Colonial Broach Co.
Consolidated Mch. Tool Corp.
Elmes Engineering Works
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General Mfg. Co.
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Morey Mchry. Co., Inc.
Pratt & Whitney

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Tuthill Pump Co.
Vickers, Inc.
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Barnes, John S., Corp.
Bethlehem Steel Co.
Brown & Sharpe Mfg. Co.
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Lapointe Machine Tool Co.
Oilgear Co.
Sundstrand Mch. Tool Co.
Tuthill Pump Co.
Vickers, Inc.
Viking Pump Co.

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Ingersoll-Rand Co.

PUMPS, Rotary
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De Laval Steam Turbine Co.
Sundstrand Machine Tool Co.
Tuthill Pump Co.
Vickers, Inc.
Viking Pump Co.

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Cleveland Punch & Shear Works Co.

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National Tool Salvage Co.
National Twist Drill & Tool Co.
Pratt & Whitney
Standard Tool Co.
Super Tool Co.
Union Twist Drill Co.
Whitman & Barnes

REAMERS, Adjustable
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Carboloy Co., Inc.
Cleveland Twist Drill Co.
Ex-Cell-O Corporation
Firth Sterling Steel & Carbide Corp.
Gairing Tool Co.
Greenfield Tap & Die Corp.
Kelly Reamer Co.
Morse Twist Drill & Mch. Co.
Pratt & Whitney
Standard Tool Co.
Taft-Peirce Mfg. Co.
Union Twist Drill Co.
Whitman & Barnes

REAMERS, Taper Pin
Butterfield Div., Union Twist Drill Co.
Chicago-Latrobe Twist Drill Wks.
Gammons-Hoaglund Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney
Standard Tool Co.
Union Twist Drill Co.
Whitman & Barnes

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Pratt & Whitney
Van Norman Co.

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Leeds & Northrup Co.

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Bristol Co.
Leeds & Northrup Co.

RECORDING INSTRUMENTS for Temperature
Bristol Co.
Leeds & Northrup Co.

REELS, Stock, Standard and Automatic
U. S. Tool Company, Inc.
Wittek Mfg. Co.

REFRACTORIES, Heat Treating Furnace
Norton Co.

REGULATORS, Temperature
Bristol Co.
General Electric Co.
Leeds & Northrup Co.

REMOVERS, Japan, Enamel, Etc.
Oakite Products, Inc.

RETAINING RINGS FOR BEARINGS, ETC.
Nice Ball Bearing Co.
Waldes Kohinoor, Inc.

RHEOSTATS
Allen-Bradley Co.
General Electric Co.
Westinghouse Electric Corp.

RIVET SETS
Bethlehem Steel Co.
Cleco Div., Reed Roller Bit Co.
Cleveland Punch & Shear Works Co.

RIVETERS, Hydraulic
Bethlehem Steel Co.
Chicago Pneumatic Tool Co.
Hanna Engineering Works
Hannifin Corp.
Morgan Engineering Co.

RIVETERS, Pneumatic
Chicago Pneumatic Tool Co
Cleco Div., Reed Roller Bit Co.
Grant Mfg. Co.
Hanna Engineering Works
Ingersoll-Rand Co.
Ryerson, Joseph T., & Son, Inc.

RIVETING MACHINES
Buffalo Forge Co.
General Mfg. Co.
Grant Mfg. & Mch. Co.
Hanna Engineering Works
Hannifin Corp.
Snyder Tool & Engrg. Co.
Tomkins-Johnson Co.

RIVET MAKING MACHINES
Hill Acme Co.
National Machinery Co.

RUBBER PRODUCTS
Raybestos-Manhattan, Inc., Manhattan Rubber Div.

RULES, Steel
Brown & Sharpe Mfg. Co.
Scherr, George, Co., Inc.
Starrett, L. S., Co.

RUST PREVENTATIVE
Oakite Products, Inc.
Scherr, George, Co., Inc.

SAND BLAST EQUIPMENT
See Blast Cleaning Equipment.

SANDERS
Buckeye Tools Corp.
Chicago Pneumatic Tool Co.
Delta Mfg. Div., Rockwell Mfg. Co.
Ingersoll-Rand Co.
Rotor Tool Co.
Sundstrand Mch. Tool Co.
Van Dorn Electric Tool Co.

SAW BLADES, Hack
Armstrong-Blum Mfg. Co.
Simonds Saw & Steel Co.
Starrett, L. S. Co.
Victor Saw Works, Inc.

SAW SHARPENING MACHINES
Earle Gear & Machine Co.
Espen-Lucas Machine Works
Motch & Merryweather Mchry. Co.
Scherr, George, Co., Inc.

SAWING MACHINES, Circular
Consolidated Machine Tool Corp.
Earle Gear & Machine Co.
Espen-Lucas Machine Works
Motch & Merryweather Mchry. Co.

SAWING MACHINES, Friction
Ryerson, Joseph T., & Son, Inc.

SAWING MACHINES, Metal Cutting Band
Armstrong-Blum Mfg. Co.
Delta Mfg. Div., Rockwell Mfg. Co.
DoAll Co.
Grob Brothers
Johnson Manufacturing Co.
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.

SAWING MACHINES, Power Hack
Armstrong-Blum Mfg. Co.
Ryerson, Joseph T., & Son, Inc.
Victor Saw Works, Inc.

SAWS, Circular Metal Cutting
Brown & Sharpe Mfg. Co.
Consolidated Mch. Tool Corp.
Espen-Lucas Machine Works
Motch & Merryweather Mchry. Co.
National Twist Drill Co.
Simonds Saw & Steel Co.
Standard Tool Co.
Union Twist Drill Co.
Walker-Turner Div., Kearney & Trecker Corp.

SAWS, Metal Cutting Band
Armstrong-Blum Mfg. Co.
Delta Mfg. Div., Rockwell Mfg. Co.
DoAll Co.
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.
Starrett, L. S., Co.
Walker-Turner Div., Kearney & Trecker Corp.
Wells Manufacturing Corp.

SAWS, Portable Electric
Van Dorn Electric Tool Co.

SAWS, Screw Slotting
Barber-Colman Co.
Brown & Sharpe Mfg. Co.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Simonds Saw & Steel Co.
Starrett, L. S., Co.
Union Twist Drill Co.

SCRAPERS, Hand and Power
Anderson Bros. Mfg. Co.

SCREW DRIVERS, Power
Chicago Pneumatic Tool Co.
Detroit Power Screwdriver Co.

SCREW DRIVING AND NUT SETTING EQUIPMENT
Buckeye Tools Corp.
Cincinnati Electric Tool Co.
Detroit Power Screwdriver Co.
Errington Mechanical Laboratory
Haskins, R. G., Co.
Ingersoll-Rand Co.
Rotor Tool Co.
Strand, N. A., & Co.
Van Dorn Electric Tool Co.

SCREW MACHINES, Automatic, Single and Multiple Spindle
Brown & Sharpe Mfg. Co.
Cleveland Automatic Machine Co.
Cone Automatic Machine Co., Inc.
Cosa Corp.
Gorton, George, Mch. Co.
Greenlee Bros. & Co.
National Acme Co.
New Britain Machine Co., New Britain-Gridley Mch. Div.
Scherr, George, Co., Inc.
Warner & Swasey Co.

SCREW MACHINE, Hand
See also Lathes, Turret.
Bardons & Oliver, Inc.
Brown & Sharpe Mfg. Co.
Gisholt Mch. Co.
Hardinge Brothers, Inc.
Rivett Lathe & Grinder, Inc.
Simmons Machine Tool Corp.
Warner & Swasey Co.

SCREW MACHINE TOOLS AND EQUIPMENT
Bardons & Oliver, Inc.
Brown & Sharpe Mfg. Co.
Cleveland Automatic Machine Co.
Gisholt Mch. Co.
Greenlee Bros. & Co
Murchey Machine & Tool Co., Div. Sheffield Corp.
National Acme Co.
New Britain Machine Co., New Britain-Gridley Mch. Div.
Potter & Johnston Co.
R and L Tools
Warner & Swasey Co.

SCREW MACHINE WORK
Aluminum Co. of America
Cleveland Automatic Machine Co.
Eastern Mch. Screw Corp.
Morse Twist Drill & Mch. Co.
National Acme Co.
Ottemiller, W. H., Co.
Standard Pressed Steel Co.
Wicaco Machine Corp.

SCREW PLATES
Butterfield Div., Union Twist Drill Co.
Card, S. W., Mfg. Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.

Pratt & Whitney
Threadwell Tap & Die Co.
Winter Bros. Co.

SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co.
Allied Products Corp.
American Screw Co.
Bristol Co.
Camcar Products Co.
Central Screw Co.
Continental Screw Co.
Corbin Screw Div. of American Hardware Corp.
Harper, H. M., & Co.
Holo-Krome Screw Corp.
International Screw Co.
Lamson & Sessions Co.
Milford Rivet & Machine Co.
Moore, George W., Inc.
National Acme Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Ottemiller, W. H., Co.
Parker-Kalon Corp.
Pawtucket Screw Co.
Pheoll Mfg. Co.
Reading Screw Co.
Republic Steel Corp., Union Drawn Steel Div.
Rockford Screw Products
Russell, Burdsall & Ward Bolt & Nut Co.
Scovill Mfg. Co.
Seaboard Screw Corp.
Shakeproof, Inc.
Southington Hardware Co.
Standard Pressed Steel Co.
Steel Co. of Canada, Ltd.
Sterling Bolt Co.
Stronghold Screw Products
Wales-Beech Corp.
Wolverine Belt Co.

SCREWS, Self-Tapping Drive

Parker-Kalon Corp.

SCREWS, Thumb

American Screw Co.
Parker-Kalon Corp.
Russell, Burdsall & Ward Bolt & Nut Co.
Williams, J. H., & Co.

SEALS AND RETAINERS, Oil and Grease

Garlock Packing Co.

SECOND HAND MACHINERY, ETC.

Botwinik Brothers of Mass., Inc.
Cincinnati Machinery Co., Inc.
Eastern Machinery Co.
Miles Machinery Co.
Simmons Machine Tool Corp.

SEPARATORS, Centrifugal

De Laval Separator Co.

SEPARATORS, Oil or Coolant

Barnes Drill Co. (Magnetic)
National Acme Co.

SHAFTING, Steel

Bethlehem Steel Co.
Cumberland Steel Co.
Republic Steel Corp., Union Drawn Steel Div.
Ryerson, Joseph T., & Son, Inc.

SHAFTS

Standard Pressed Steel Co.

SHAFTS, Flexible

Haskins, R. G., Co.
Strand, N. A., & Co.

SHAFTS, Hollow Bored

American Hollow Boring Co.
Bethlehem Steel Co.

SHAFTS, Turned and Ground

Bethlehem Steel Co.
Cumberland Steel Co.
Ryerson, Joseph T., & Son, Inc.

SHAPERS

American Tool Works Co.
Cincinnati Shaper Co.
Hendey Machine Co.
Rockford Mch. Tool Co.
Sheldon Machine Co.

SHAPERS, Vertical

Pratt & Whitney
Rockford Mch. Tool Co.

SHAPES, Structural

Aluminum Co. of America
Bethlehem Steel Co.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.)

SHEARING MACHINERY

Bethlehem Steel Co.
Buckeye Tools Corp. (Portable)
Buffalo Forge Co.
Cincinnati Shaper Co.
Cleveland Crane & Engrg. Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Ferracute Machine Co.
Hannifin Corp.
Hydropress, Inc.
Morgan Engineering Co.
Niagara Mch. & Tool Wks.
O'Neil-Irwin Mfg. Co.
Ryerson, Joseph T., & Son, Inc.
Van Dorn Electric Tool Co. (Portable)
Whiting Corp.
Yoder Co.

SHEARS, Alligator

Hill Acme Co.
Hydropress, Inc.

SHEARS, Rotary

Bliss, E. W., Co.
Brown & Sharpe Mfg. Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Hydropress, Inc.
Niagara Mch. & Tool Wks.
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co. (Knives)
Union Twist Drill Co.
Whiting Corp.

SHEARS, Squaring

Cincinnati Shaper Co.
Cleveland Punch & Shear Works Co.
Consolidated Mch. Tool Corp.
Niagara Mch. & Tool Wks.
Simonds Saw & Steel Co. (Blades)

SHEET METALS

Aluminum Co. of America
American Brass Co.
Bethlehem Steel Co.
Ingersoll Steel Div., Borg-Warner Corp.
Ryerson, Joseph T., & Son, Inc.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.)

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Republic Steel Corp., Union Drawn Steel Div.
Ryerson, Joseph T., & Son, Inc.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.)
Ward Steel Co.

Perforated

Chicago Perforating Co.
Harrington & King Perforating Co.

SINE BARS AND PLATES

Robbins, Omer E., Co.

SLEEVES

Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Haynes Stellite Co.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney
Standard Tool Co.
Union Twist Drill Co.
Whitman & Barnes

SLOTTING MACHINES

Baker Brothers, Inc.
Consolidated Mch. Tool Corp.
Rockford Mch. Tool Co.

SOCKETS

Armstrong Bros. Tool Co.
Chicago-Latrobe Twist Drill Wks.
Cleveland Twist Drill Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
National Twist Drill & Tool Co.
Pratt & Whitney
Standard Tool Co.
Union Twist Drill Co.
Whitman & Barnes
Williams, J. H., & Co.

SPECIAL MACHINERY AND TOOLS

Baird Machine Co.
Baldwin Locomotive Works
Barnes Drill Co.
Barnes, W. F. & John, Co.
Bath, Cyril, & Co.
Baush Machine Tool Co.
Bethlehem Steel Co.
Bilgram Gear & Mch. Wks.
Birdsboro Steel Fdry. & Mch. Co.
Blanchard Machine Co.
Bliss, E. W., Co.
Chambersburg Engineering Co.
Columbus Die, Tool & Machine Co.
Consolidated Mch. Tool Corp.
Coulter, James, Mch. Co.
Earle Gear & Machine Co.
Elgin Tool Wks., Inc.
Espen-Lucas Machine Works
Ex-Cell-O Corp.
Fellows Gear Shaper Co.
Farrel-Birmingham Co., Inc.
Gairing Tool Co.
Gisholt Mch. Co.
Gorton, George, Mch. Co.
Grant Mfg. & Mch. Co.
Greenlee Bros. & Co.
Hannifin Corp.
Hartford Special Mchry. Co.
Hill Acme Co.
Hydraulic Press Mfg. Co.
Hydropress, Inc.
Ingersoll Milling Mch. Co.
Knight, W. B., Mchy. Co.
Lake Erie Engineering Corp.
Langelier Mfg. Co.
Moline Tool Co.
Morgan Engineering Co.
National Acme Co.
National Automatic Tool Co.
National Broach & Mch. Co.
National-Erie Corp.
National Twist Drill & Tool Co.
New Britain Machine Co., New Britain-Gridley Mch. Div.
New Jersey Gear & Mfg. Co.
Niagara Mch. & Tool Wks.
Oilgear Co.
Pratt & Whitney
Rivett Lathe & Grinder, Inc.

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Robbins, Omer E., Co.
Seneca Falls Mch. Co.
Snyder Tool & Engrg. Co.
Sundstrand Mch. Tool Co.
Taft-Peirce Mfg. Co.
Union Twist Drill Co.
V & O Press Co.
Waltham Machine Works, Inc.
Wicaco Machine Corp.

SPEED REDUCERS

Atlantic Gear Works, Inc.
Boston Gear Works, Inc.
Cleveland Worm & Gear Co.
Cullman Wheel Co.
De Laval Steam Turbine Co.
Farrel-Birmingham Co., Inc.
Ganschow Gear Co.
General Electric Co.
James, D. O., Gear Mfg. Co.
Ohio Gear Co.
Philadelphia Gear Works
Shepard Niles Crane & Hoist Corp.
Twin Disc Clutch Co.
U. S. Electrical Motors, Inc.
Westinghouse Electric Corp.

SPINDLES, Grinding

Ex-Cell-O Corporation
Pope Machinery Corp.

SPINDLES, Hollow Bored

American Hollow Boring Co.

SPINNING LATHES

See Chucking Machines.

SPRING COILING AND FORMING MACHINERY

Baird Machine Co.

SPROCKET CHAINS

Atlantic Gear Works, Inc.
Boston Gear Works, Inc.
Cullman Wheel Co.
Philadelphia Gear Works

SPROCKETS

Atlantic Gear Works, Inc.
Boston Gear Works, Inc.
Cullman Wheel Co.
Hartford Special Mchry. Co.
Industrial Gear Mfg. Co.
National-Erie Corp.
Ohio Gear Co.
Philadelphia Gear Works
Stahl Gear & Mch. Co.

STAMPINGS, All Metals

Worcester Pressed Steel Co.

STAMPINGS, Sheet Metal

Aluminum Co. of America
Revere Copper & Brass, Inc.
Rogers, Dayton, Mfg. Co.

STAMPS, Steel, and Marking Dies

Noble & Westbrook Mfg. Co.
Pittsburgh Stamp Co., Inc.

STEEL

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Firth Sterling Steel & Carbide Corp.
Ingersoll Steel Div., Borg-Warner Corp.
Republic Steel Corp.,
Union Drawn Steel Div.
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.
Timken Roller Bearing Co.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.)
Vanadium-Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

STEEL, Cold Drawn

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Firth Sterling Steel & Carbide Corp.
Republic Steel Corp., Union Drawn Steel Div.
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
U. S. Steel Corp., American Steel & Wire Co. Div.
Vanadium-Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp.
Armstrong Bros. Tool Co.
Bethlehem Steel Co.
Carpenter Steel Co.
Firth Sterling Steel & Carbide Corp.
Republic Steel Corp.,
Union Drawn Steel Div.
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.
Vanadium-Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

STEEL, Machine

Bethlehem Steel Co.
Republic Steel Corp.,
Union Drawn Steel Div.
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
Vanadium-Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.

STEEL, Stainless

Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Firth Sterling Steel & Carbide Corp.
Ingersoll Steel Div., Borg-Warner Corp.
Republic Steel Corp.,
Union Drawn Steel Div.
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div.)
Wheelock, Lovejoy & Co.,Inc.

STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp.
Bethlehem Steel Corp.
Republic Steel Corp.,
Union Drawn Steel Div.
Ryerson, Joseph T., & Son, Inc.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron, & R. R. Co. Div.)
Ward Steel Co.

STEEL, Tool and Die

Allegheny Ludlum Steel Corp.
Firth Sterling Steel & Carbide Corp.
Simonds Saw & Steel Co.

STEEL, Zinc, Tin and Copper Coated Strip

Allegheny Ludlum Steel Corp.

STEEL ALLOYS

See Alloy Steels.

STEEL BARS—See Bars, Steel.

STEEL STOCK GROUND FLAT

Brown & Sharpe Mfg. Co.
Starrett, L. S., Co.

STELLITE

Haynes Stellite Co. (Alloy)

STOCKS, Die

Armstrong Bros. Tool Co.
Butterfield Div., Union Twist Drill Co
Card, S. W., Mfg. Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
Pratt & Whitney
Standard Tool Co.
Threadwell Tap & Die Co.

STONES, Oil or Sharpening

Bay State Abrasive Co.
Carborundum Co.
Norton Co.

STOOLS

Standard Pressed Steel Co.

STRAIGHT EDGES

Brown & Sharpe Mfg. Co.
Starrett, L. S., Co.

STRAIGHTENERS, Flat Stock and Wire

U. S. Tool Co., Inc.

STRAIGHTENING MACHINERY

Baldwin Locomotive Works
Chambersburg Engineering Co.
Consolidated Mch. Tool Corp.
General Mfg. Co.
Hannifin Corp.
Hydraulic Press Mfg. Co.
Hydropress, Inc.
Lake Erie Engineering Corp.
Morse Twist Drill & Mch. Co.
Oilgear Co.
Springfield Mch. Tool Co.

STUD SETTERS

Errington Mechanical Laboratory
Procunier Safety Chuck Co.

SUB PRESSES

Baumbach, E. A., Mfg. Co.
Waltham Machine Works, Inc.

SUPERFINISHING MACHINES

Gisholt Mch. Co.

SURFACE PLATES

See Plates, Surface.

SWAGING MACHINES

Cincinnati Shaper Co.
Langelier Mfg. Co.
Torrington Co.

SWITCHES

Allen-Bradley Co.
General Electric Co.
National Acme Co.
Shepard Niles Crane & Hoist Corp.
Westinghouse Electric Corp.

TACHOMETERS

Bristol Co.
Leeds & Northrup Co.
Scherr, George, Co., Inc.
Veeder-Root Inc.

TAPER PINS, Standard

Morse Twist Drill & Mch. Co.
Pratt & Whitney

TAP HOLDERS

Errington Mechanical Laboratory
Gairing Tool Co.
National Automatic Tool Co.

TAPPING ATTACHMENTS AND DEVICES

Baker Brothers, Inc.
Brown & Sharpe Mfg. Co.
Detroit Tap & Tool Co.
Errington Mechanical Laboratory
Ettco Tool Co.
Leland-Gifford Co.
National Automatic Tool Co.
Procunier Safety Chuck Co.
Snow Mfg. Co.
Thriftmaster Products Corp.

TAPPING MACHINES
Baker Brothers, Inc.
Barnes Drill Co.
Barnes, W. F. & John, Co.
Baush Machine Tool Co.
Bodine Corp.
Buffalo Forge Co.
Challenge Machinery Co.
Cross Co.
Detroit Tap & Tool Co.
Elgin Tool Works, Inc.
Greenlee Bros. & Co.
Hill Acme Co.
Kingsbury Mch. Tool Corp.
Langelier Mfg. Co.
Leland-Gifford Co.
Moline Tool Co.
Murchey Machine & Tool Co., Div. Sheffield Corp.
National Acme Co.
National Automatic Tool Co.
Procunier Safety Chuck Co.
Snow Mfg. Co.
Warner & Swasey Co.

TAPPING MACHINES, Nut
Hill Acme Co.
National Machinery Co.
Snow Mfg. Co.

TAPS
Bath, John, & Co., Inc.
Besly, Chas. H., & Co.
Butterfield Div., Union Twist Drill Co.
Card, S. W., Mfg. Co.
Continental Tool Works Div.
Detroit Tap & Tool Co.
Geometric Tool Co.
Greenfield Tap & Die Corp.
Hanson-Whitney Mch. Co.
Hy-Pro Tool Co.
Landis Machine Co. (Solid Adjustable)
Morse Twist Drill & Mch. Co.
Murchey Machine & Tool Co., Div. Sheffield Corp.
Pratt & Whitney
Standard Tool Co.
Sheffield Corp.
Threadwell Tap & Die Co.
Winter Bros. Co.
Wood & Spencer Co.
Woodworth, N. A., Co.

TAPS, Collapsing
Geometric Tool Co.
Landis Mch. Co.
Murchey Machine & Tool Co., Div. Sheffield Corp.
National Acme Co.
Sheffield Corp.

THERMOMETERS, Indicating and Recording
Bristol Co.
Leeds & Northrup Co.

THREAD CUTTING MACHINERY
Brown & Sharpe Mfg. Co.
Coulter, James, Mch. Co.
Davis & Thompson Co.
Eastern Machine Screw Corp.
Fellows Gear Shaper Co.
Grant Mfg. & Mch. Co.
Hill Acme Co.
Landis Mch. Co.
Murchey Machine & Tool Co., Div. Sheffield Corp.
Pratt & Whitney
Rivett Lathe & Grinder, Inc.
Snow Mfg. Co.
Taft-Peirce Mfg. Co.
Warner & Swasey Co.

THREAD CUTTING TOOLS
Armstrong Bros. Tool Co.
Detroit Tap & Tool Co.
Eastern Machine Screw Corp.
Fellows Gear Shaper Co.
Geometric Tool Co.
Hill Acme Co.
Landis Mch. Co.
Pratt & Whitney
Rivett Lathe & Grinder, Inc.
Sheffield Corp.
Taft-Peirce Mfg. Co.
Williams, J. H., & Co.

THREAD GAGES
See Gages, Thread.

THREAD GRINDING MACHINES
See Grinding Machines, Thread.

THREAD MILLING MACHINES
Cosa Corp.
Coulter, James, Mch. Co.
Cross Co.
Hanson-Whitney Mch. Co.
Murchey Machine & Tool Co., Div. Sheffield Corp.
Pratt & Whitney
Waltham Machine Works, Inc.

THREAD ROLLING MACHINES
Hill Acme Co.
National Machinery Co.
V & O Press Co.

TIN AND TERNE PLATES
Bethlehem Steel Co.
Republic Steel Corp., Union Drawn Steel Div.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div. Tennessee Coal, Iron, & R. R. Co Div.)

TOOL BITS, High Speed Steel
Allegheny Ludlum Steel Corp.
Armstrong Bros. Tool Co.
Carpenter Steel Co.
Firth Sterling Steel & Carbide Corp.
Ryerson, Joseph T., & Son, Inc.
Simonds Saw & Steel Co.
Vanadium-Alloys Steel Co.
Wheelock, Lovejoy & Co., Inc.
Williams, J. H., & Co.

TOOL BITS, Special Alloy
Allegheny Ludlum Steel Corp.
Cleveland Twist Drill Co.
Firth Sterling Steel & Carbide Corp.
Haynes Stellite Co.
Kennametal, Inc.

TOOL GRINDERS
See Grinders for Sharpening, Turning and Planing Tools.

TOOL HEADS, Adjustable
Gairing Tool Co.

TOOL HOLDERS
Armstrong Brothers Tool Co.
Lovejoy Tool Co., Inc.
Michigan Tool Co.
R and L Tools
Warner & Swasey Co.
Williams, J. H., & Co.

TOOLMAKERS' INSTRUMENTS
Ames, B. C., Co.
Brown & Sharpe Mfg. Co.
Scherr, George, Co., Inc.
Starrett, L. S., Co.

TOOL STEEL
Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Firth Sterling Steel & Carbide Corp.
Ryerson, Joseph T., & Son, Inc.
Vanadium-Alloys Steel Co.

TOOLS, Carbide-Tipped
Allegheny Ludlum Steel Corp.
Carboloy Co., Inc.
Chicago-Latrobe Twist Drill Wks
Cleveland Twist Drill Co.
Ex-Cell-O Corporation
Firth Sterling Steel & Carbide Corp.
Gairing Tool Co.
Kelly Reamer Co.
Kennametal, Inc.
Metal Carbides Corp.
Morse Twist Drill & Mch. Co.
National Tool Salvage Co.
Pratt & Whitney
Super Tool Co.
Whitman & Barnes

TOOLS, Lathe Shaper and Planer
Allegheny Ludlum Steel Corp.
Armstrong Brothers Tool Co.
Firth Sterling Steel & Carbide Corp.
Gairing Tool Co.
Haynes Stellite Co.
Kennametal, Inc.
Lovejoy Tool Co., Inc.
Super Tool Co.
Warner & Swasey Co.
Williams, J. H., & Co.

TRANSFER MACHINES
Cross Co.
Sundstrand Machine Tool Co.

TRANSFORMERS
General Electric Co.

TRANSMISSION MACHINERY
See Hangers, Shafting, Pulleys, Clutches, Couplings, Belting, Chains, Etc.

TRANSMISSION, Variable Speed
Atlantic Gear Works, Inc.
DoAll Co.
Oilgear Co.
Reeves Pulley Co.
Reliance Electric & Engrg. Co.
Sundstrand Machine Tool Co.

TUBE FLANGING MACHINES
Grant Mfg. & Mch. Co.

TUBE FORMING AND WELDING MACHINES
American Electric Fusion Corp.
Yoder Co.

TUBING, Aluminum
Aluminum Co. of America

TUBING, Brass and Copper
American Brass Co.
Revere Copper & Brass, Inc.

TUBING, Flexible
American Metal Hose Branch, American Brass Co.
Chicago Metal Hose Corp.
Titeflex, Inc.

TUBING, Steel
Allegheny Ludlum Steel Corp.
Bethlehem Steel Co.
Carpenter Steel Co.
Chicago Metal Hose Corp.
Roehr Products Co.
Ryerson, Joseph T., & Son, Inc.
Timken Roller Bearing Co.
U. S. Steel Corp., National Tube Co Div
Ward Steel Co.

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Whiton Machine Co.

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Elmes Engineering Works
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Hydropress, Inc.
Logansport Machine Co., Inc.
Oilgear Co.
Sundstrand Mch. Tool Co.
Vickers, Inc.

VALVES, Pneumatic
Hanna Engineering Works
Hannifin Corp.

VIBRATION INSULATION
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VISES, Machine
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Armstrong Brothers Tool Co.
Brown & Sharpe Mfg. Co.
Fenn Mfg. Co.
Graham Mfg. Co.
Hannifin Corp.
Hendey Mch. Co.
Logansport Machine Co., Inc.
National Machine Tool Co.
Skinner Chuck Co.

VISES, Pipe
Armstrong Bros. Tool Co.
Williams, J. H., & Co.

VISES, Planer and Shaper
Brown & Sharpe Mfg. Co.
Cincinnati Planer Co.
Cincinnati Shaper Co.
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Skinner Chuck Co.

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General Electric Co.

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WIRE NAIL MACHINERY
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Ryerson, Joseph T., & Son, Inc.

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Walker-Turner Div., Kearney & Trecker Corp.

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De Laval Steam Turbine Co.
Philadelphia Gear Works

WRENCHES
Armstrong Brothers Tool Co
Standard Tool Co
Williams, J. H., & Co.

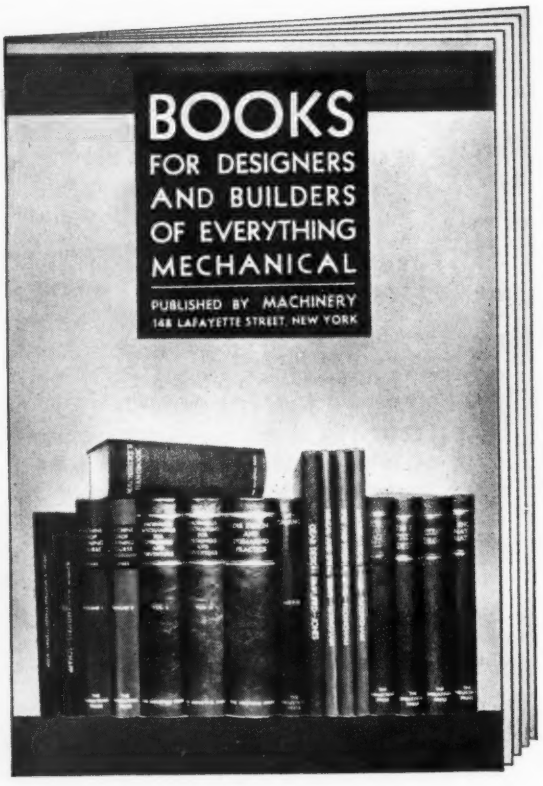
WRENCHES, Detachable Socket
Armstrong Bros. Tool Co.
Williams, J. H., & Co.

WRENCHES, Pipe
Armstrong Bros. Tool Co.

WRENCHES, Ratchet
Armstrong Bros. Tool Co.
Williams, J. H., & Co.

WRENCHES, Tap
Butterfield Div., Union Twist Drill Co.
Card, S. W., Mfg. Co.
Greenfield Tap & Die Corp.
Morse Twist Drill & Mch. Co.
Pratt & Whitney
Standard Tool Co.

WRENCHES, Torque Measuring
Armstrong Bros. Tool Co.
Sturtevant, P. A., Co.
Williams, J. H., & Co.



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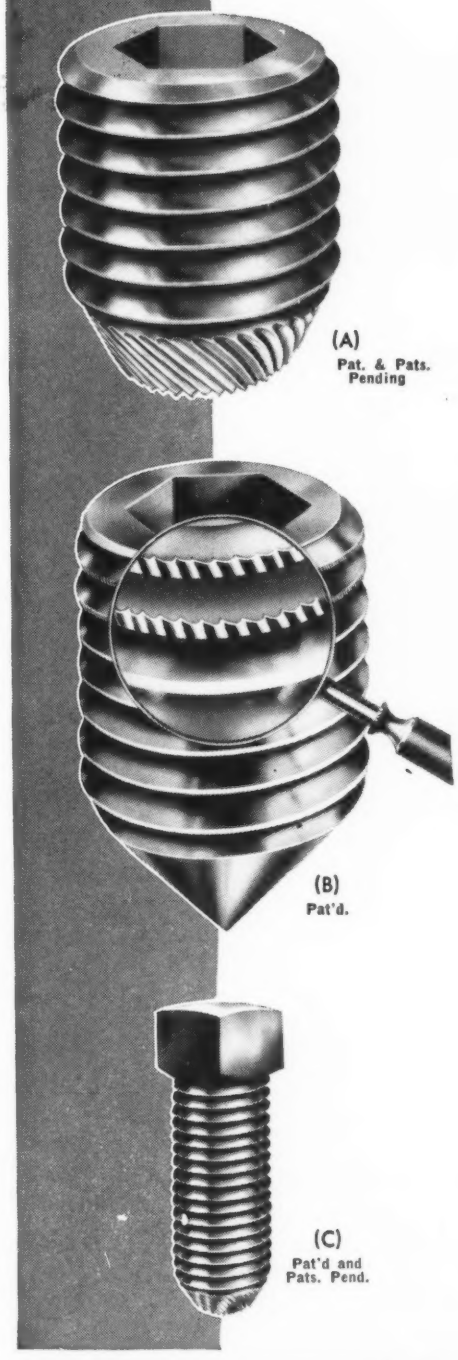

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Reg. U. S. Pat. Off.

SET SCREWS

(A) The KNURLED cup point of this patented "Unbrako" Socket Set Screw makes it a Self-Locker . . . because the keen edges of the counter-clockwise KNURLS prevent creep, regardless of the most chattering vibration. A real fastener, if ever there was one . . . it positively *won't shake loose!*

(B) The KNURLING . . . as shown . . . swages the threads of this patented "Unbrako" Socket Set Screw, so that it becomes a most excellent Self-Locker . . . for use with cone, flat, oval, half and full dog points which cannot be knurled . . . a Set Screw that positively *will not shake loose!*

(C) Made of a special alloy steel, the "Unbrako" Square Head Set Screw is a "brute" for strength. The KNURLING of the Cup Point, either internally or externally, provides an excellent patented Self-Locking feature . . . positively will not shake loose, in spite of the most chattering vibration!

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"UNBRAKO" SOCKET SET SCREW *Plain Cup Point*

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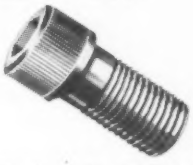
"UNBRAKO" KNURLED SOCKET HEAD CAP SCREW



The head of this "Unbrako" Socket Head Cap Screw is *knurled* to speed assembly. The *knurls* "gear" right to the fingers, no matter how oily, and a positive slip-proof grip is the result . . . no waste motion.

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The unit operates a Ruggles-Coles Dryer, built by the Hardinge Co., Inc., York, Pa.

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For full description, send for Catalog 300. The Cleveland Worm & Gear Co., 3276 East 80th St., Cleveland 4, Ohio.

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CLEVELAND
Worm Gear
Speed Reducers

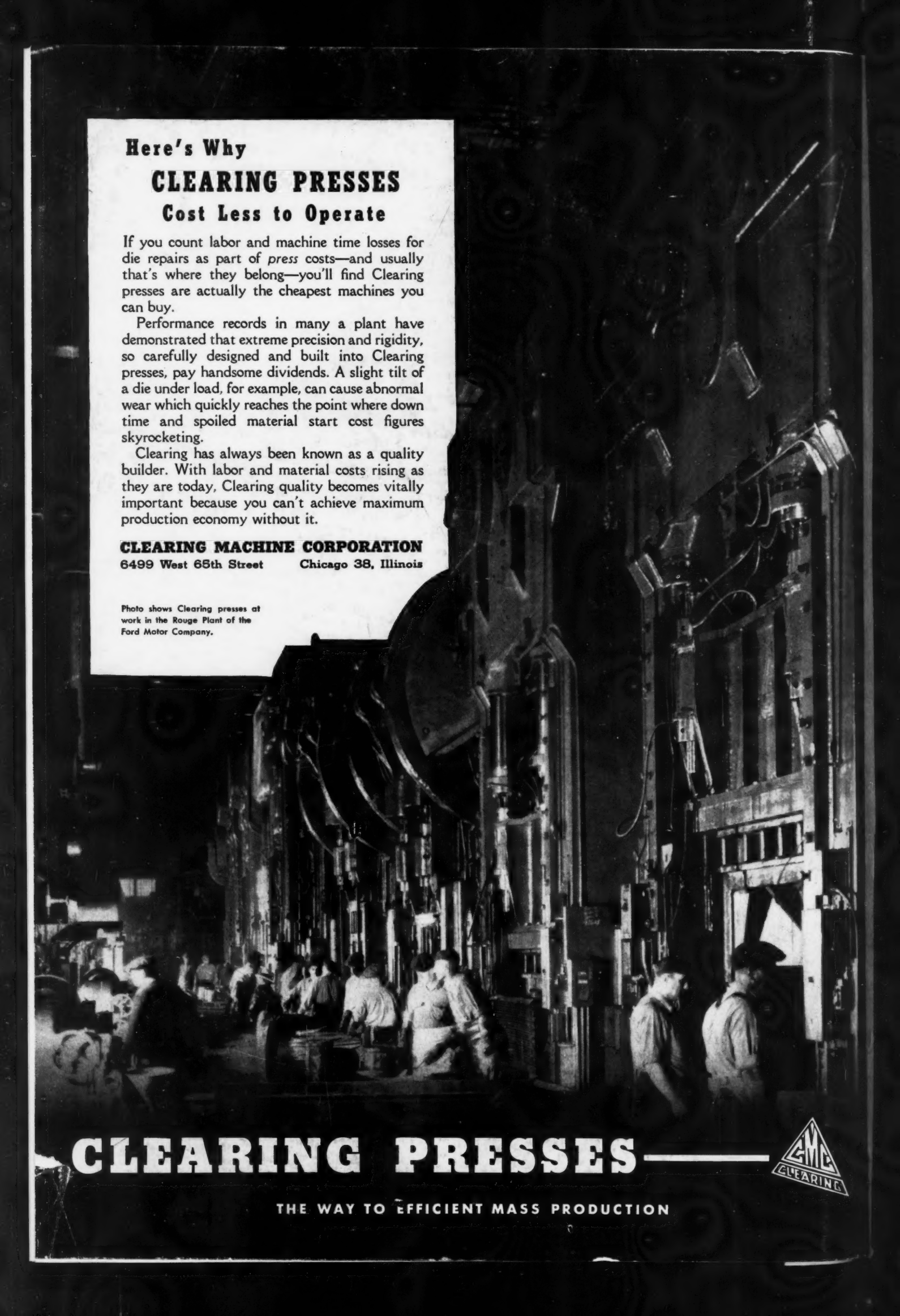

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Photo shows Clearing presses at work in the Rouge Plant of the Ford Motor Company.

CLEARING PRESSES

CMC CLEARING

THE WAY TO EFFICIENT MASS PRODUCTION